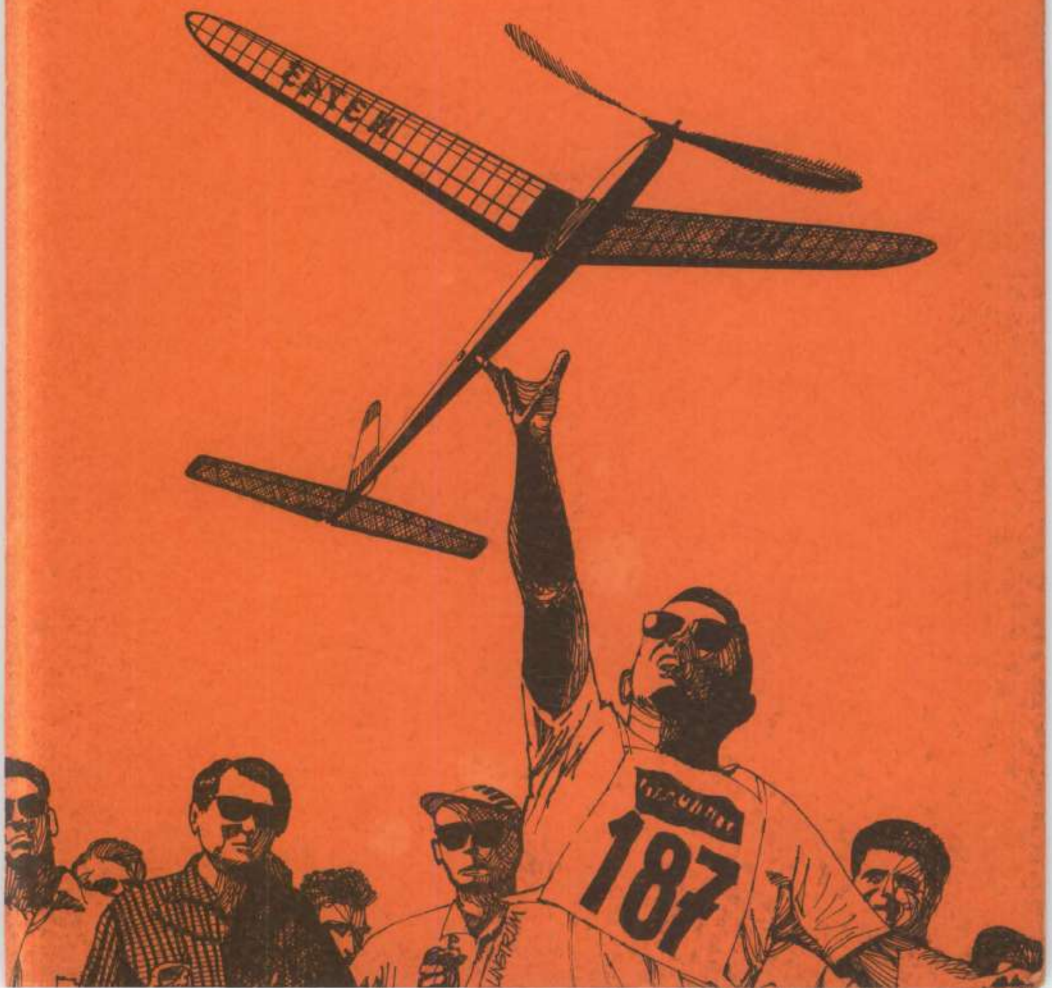
1964-65
MODEL AERONAUTIC YEAR BOOK

by Frank Zaic



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Edited by

Frank Zaic

MODEL AERONAUTIC PUBLICATIONS

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Box 135 . Northridge . California

To BOB CLARY +
Originator of Microfilm

All of us who build and
fly model planes have a
common heritage. —
Heritage which harks back
into time when the first
man defied gravity by
tossing a leaf over a cliff
and watched it join the
eagles above.

Frank Zaic

September, 1965
Northridge, Calif.

YOUR LIFETIME COMPANION

Carl W. Hermes Bremerton, Wash.

I have thought quite a bit about your question, "What is there for the FAI flyers who feel they have had it ?" I feel the first thing that has to be done is define just exactly who you are referring to. I know that I find myself with considerably less enthusiasm for Wakefield today than I had 10 years ago. I think this is generally true as you grow older. In fact when you think back you can remember dozens of flyers who we never hear from today. I feel that it is this group (if you want to call them that) who really have "had it" in the ultimate sense of the word. But I am sure it is not this category that we want to talk about. I feel it is more like the guy who remains pretty dormant most of the year insofar as model building is concerned, but given a situation involving the first breath of spring and the word that the eliminations have been scheduled, feels the old stirring.

Normally there is no workshop so he finds himself with no place to spread out a clean piece of paper, check the stock and get started on something. He does, however, find himself with a tremendous urge to get something in the air . . . of course this something has to be potentially the world's greatest Wakefield or it's not worth fooling with. It has to have at least one new idea incorporated in it whether it be a new prop assembly or method of securing the rear end of the motor. When I find myself in this position, I guess what I would really like to do is come up with something that would provide a step increase in the Wakefield performance.

So here I am full of enthusiasm, ideas, nothing but a lot of sketches on paper and no place to hack balsa. Whatever I came up with was going to have to be simple and not require too much construction time. The Olympias were built on kitchen tables, etc. and being of fairly conventional construction had to remain pinned down for extended periods of time. This naturally imposed a tremendous strain on the family relationships; therefore, the problem at hand was twofold — one, to build an outstanding model and second, to be able to build it quickly and in a manner that would keep to a minimum the impact on the household. I had been particularly impressed with Ericson's Nordic winner and thought that all balsa might be the answer. The idea of building a Wakefield "in the air" ala hand-launched glider was rather intriguing and I thought there might be others in the same situation I am who would be interested.

Lately I had been fiddling with ideas to reduce the camber of the airfoil during the initial high torque portion of the motor run. An all balsa wing lent itself nicely to 3 hinged sections for the variable camber idea. The sections could be laid out and all of the carving and sanding could be done on a flat board just about anywhere.

As you know, Frank, we now live out in the country just north of Bremerton, Washington and the place where we live is located on a fairly good sized bay with a little town of about 800 people on the opposite shore. Beyond this are the Olympic mountains which make for quite a picturesque setting. On many Sunday afternoons Norma and I will walk down to the beach and I'll sit and sand a wing or hack out a prop for a couple of hours while she goes and pokes at clams and chases seagulls. Since no cutting or sanding is allowed in the house, if you plan the work properly you can set it up so that all of this can be done out of doors. There is an old barn on the property here where I have set up an old box as a workbench. The door faces a primeval woods and the whole setting is extremely conducive to soothing the jangled nerves of the work week. I have an FM portable providing the proper background music. I guess it was back in the old days at Jasco when I learned that a little Mozart or Wagner was important in providing the proper setting for creative thought.

Of course through all this you must remember that I am developing a Wakefield that is going to climb higher and come down slower than any other that has ever been built. It is also going to be capable of being carved out in 2 weekends. When you lose one you suffer no more pain than that associated with the loss of a hand-launched glider. One of the problems of flying an intricately constructed model in competition is that you tend to hold back for fear of tearing it up or losing it. This feeling will clobber you every time ! Contest models should be built with no emotional involvement in any one of them, only with the basic design.

I must admit now that the all balsa job will never particularly cause the Bilgi's and Kneeland's to lose any sleep. It has turned out to be a rather nice little Wakefield that could be worked up into something fairly good. The important thing is that it involved a lot of creative effort and I enjoyed every minute of building and testing it.

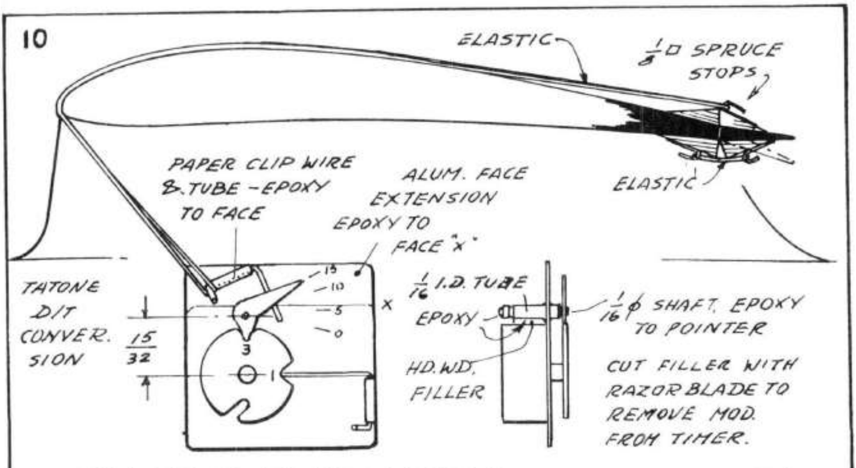
So I guess when it comes to being the demon FAI flyer who attends every contest within a 700 mile radius and spends evenings and all weekends building or flying, I guess you'd say I too have "had it". Other obligations certainly assume a higher priority. On the other hand I think I have found something in the hobby that I haven't always seen. I am treating it as a hobby and not as the beginning and end of everything. So my suggestions, Frank, for the guys who also have had it, so to speak, are to sit down, think over what could be done to improve the "state of the art", forget the old tried and true methods and start with a fresh approach. Let the ideas come fast — don't stew about them too long however — get something three dimensional worked out and see what it looks like for real. I think perhaps the guys who are in the category are entering on one of the nicest phases of this activity — that is the opportunity to do creative work without the extreme pressure of maintaining a "reputation" on the contest field. I remember what you said at the beginning of the '61 yearbook . . . something to the effect that by now many of us have realized that we have an ejoyable and lifetime hobby; therefore let us treat it as we would a lifetime companion.

I mentioned earlier some experiments with changing the camber during the initial portion of the motor run. This idea is not new, of course, but I have never seen it applied to rubber models. What started me on this thing was the fact that the adjustment of the Wakefield always seemed to be a compromise between the high power of the initial burst and the medium power of the cruise. Actually it appears that almost half the total energy stored in the rubber is released in the first 5 or 10 seconds of the motor run. Often this period is something that we feel we just must get the model through so it can end up flying normally. If you do control it with down thrust, you generally end up with the model being under elevated for the cruise portion of the motor run. So this led me to wonder what would happen if I hinged the trailing edges on one of the old Olympias and somehow rigged it up to the timer — the idea being to hold it in a reflex position for say 10 seconds and then let it drop back to normal for the remainder of the flight.

The idea worked just fine except that due to the turn characteristics of the particular model I could only use the left trailing edge in this manner. Putting both trailing edges in the reflex position threw the model into a vicious right bank at the beginning of the flight. So rather than fool with retrimming the model I decided to stay with just the left side. This worked perfectly. I was able to reduce the amount of down thrust by 50% thereby improving the latter portion of the climb.

The beautiful part, however, was the way the model handled with the first burst of torque. It would climb almost straight up with no turn for about 5 or 6 seconds and then gradually veer off to the right into its normal climb. The surprising thing was that I had to set the timer for about 3 seconds rather than the 10 I had originally anticipated. Response of the model at this point in its flight was extremely sluggish and it took about 5 seconds for it to figure out that its airfoil had been changed. Hinging the trailing edges also gave me the opportunity to experiment with deflection and I found that the climb was considerably improved with a slight degree of flap.

As part of this project I also figured out a way to use a standard Tatone DT timer to trip the flap at 3 seconds and still give you a means of dethermalizing the model at various times. My original arrangement was simply adding another trigger to the face of the timer located at a position that would allow it to trip 3 seconds after you released the timer for a 3 minute flight. The only problem with this was that you could never set the timer for less than 3 minutes. I am enclosing a sketch of the final modification which allows you complete flexibility in both flap trigger and DT setting. This could also be used very nicely in power to eliminate the need for two timers (John will shoot me).

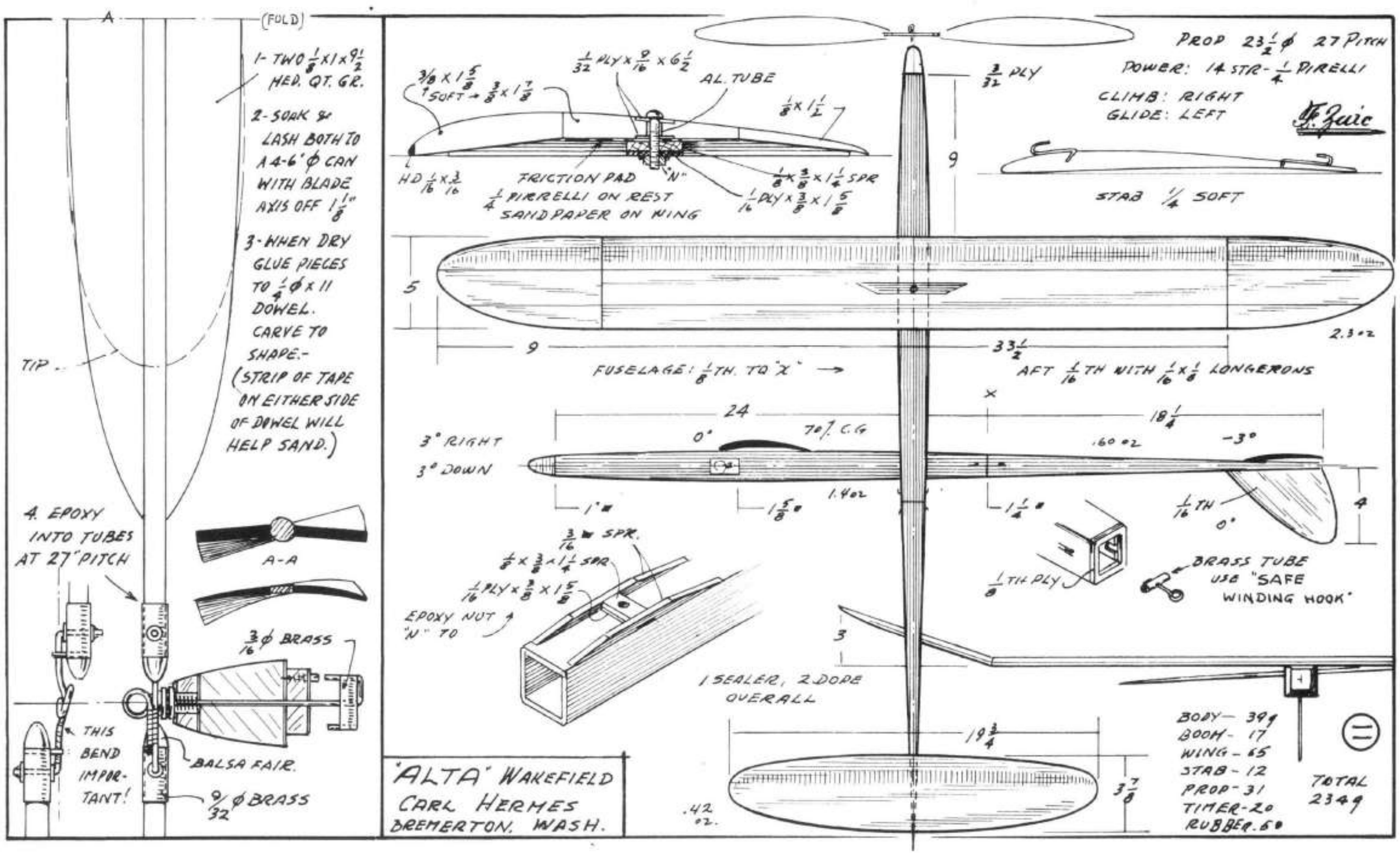


OLYMPIA INSTALLATION. LEFT WING ONLY

Since this all worked out so well I thought I would go all the way and build a wing with both leading and trailing edges movable. This would allow you to start out with a flat section or even convex airfoil which would later miraculously transform into the latest Benedek. I must also admit that I was additionally inspired while sitting in a Boeing 727 looking out the window and watching the amazing wing come unglued for landing. Frankly to-date I have not completely explored the idea. I simply ran out of propellers. Remember you are trying to observe the flight characteristics of this thing under full power and you end up with many pile-ins. Also I had under estimated the air loads that would be imposed on this little structure during the initial burst with the result that my linkage and mechanisms were a little too flimsy and I ended up with some rather continuous flapping. I must admit I became rather discouraged at this point and decided to glue the whole wing together, stick on my last remaining prop and try my hand at a local contest that was coming up in Tacoma. Meanwhile back to the beach and the seagulls and more prop carving!

I am enclosing a sketch of the all-balsa job. It is fairly straight forward. The flat center section was used primarily to simplify the flapping arrangement. I was also curious to see how little dihedral I could get away with. The amount shown is more than adequate. Needless to say, the wood for the wing and tail must be the lightest that you can lay your hands on.

The bolt-on arrangement seems the logical choice for the wing due to its very soft leading and trailing edges. This idea is not new but it was the first time I had seen it applied to a Wakefield and surprisingly enough it worked out extremely well. The model has headed straight down, sideways and cartwheeled without any damage to

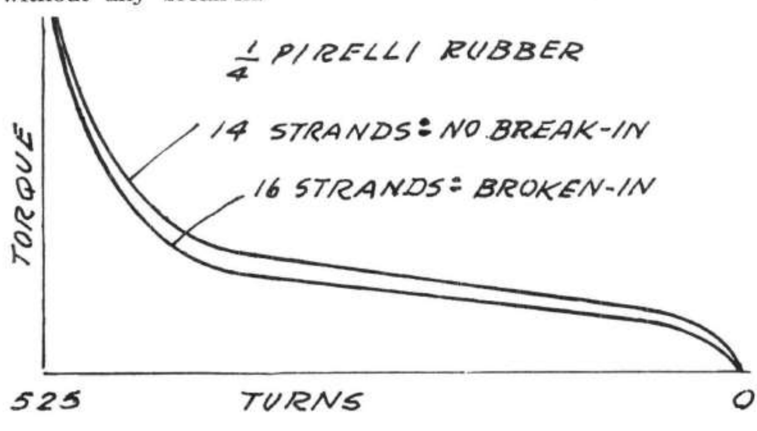


A
(FOLD)
1- TWO 1/8 x 1 x 9 1/2 MED. QT. GR.
2- SOAK & LASH BOTH TO A 4-6" ϕ CAN WITH BLADE AXIS OFF 1 1/8"
3- WHEN DRY GLUE PIECES TO 1/4 ϕ x 11 DOWEL. CARVE TO SHAPE.- (STRIP OF TAPE ON EITHER SIDE OF DOWEL WILL HELP SAND.)
TIP
4. EPOXY INTO TUBES AT 27" PITCH
A-A
3/16 ϕ BRASS
THIS BEND IMPORTANT!
BALSA FAIR.
9/32 ϕ BRASS
3/8 x 1 5/8 SOFT → 3/8 x 1 7/8
1/32 PLY x 9/16 x 6 1/2
AL. TUBE
1/8 x 1 1/2
HD 1/16 x 3/16
FRICTION PAD 1/4 PIRRELLI ON REST SANDPAPER ON WING
"N"
1/8 x 3/8 x 1 1/4 SPR
1/16 PLY x 3/8 x 1 5/8
3/32 PLY
9
PROP 23 1/2 ϕ 27 PITCH
POWER: 14 STR - 1/4 PIRELLI
CLIMB: RIGHT
GLIDE: LEFT
STAB 1/4 SOFT
5
9
33 1/2
2.3 oz
FUSELAGE: 1/8 TH. TO "X" →
AFT 1/16 TH WITH 1/16 x 1/8 LONGERONS
X
24
18 1/4
0°
70% C.G.
.60 oz
-3°
3° RIGHT
3° DOWN
1"
1 5/8"
1.4 oz
1 1/4"
1/16 TH
0°
4
3/16 SPR.
1/8 x 3/8 x 1 1/4 SPR.
1/16 PLY x 3/8 x 1 5/8
EPOXY NUT "N" TO
1/8 TH. PLY
BRASS TUBE USE "SAFE WINDING HOOK"
3
1 SEALER, 2 DOPE OVERALL
19 3/4
3 7/8
.42 oz.
BODY - 39 g
BOOM - 17
WING - 65
STAB - 12
PROP - 31
TIMER - 20
RUBBER - 60
TOTAL 234 g
"ALTA" WAKEFIELD
CARL HERMES
BREMERTON, WASH.

the wing or its attachment. The strip of sandpaper on the wing and the Pirelli contact-cemented to the wing mount provide a firm attachment but one that moves very easily with a high shock load. The first time I ever saw this was on a free flight power model by Paul Lindberg back in the 1937 Popular Aviation. The method is far superior to rubber bands although perhaps the most practical is the plug-in wires.

I don't think smooth curving of the lower camber would improve performance, so as you would notice it. It was made this way primarily for simplicity since the wing was made in 3 sections. The motor is wound from the rear. This is the logical way to do it since it eliminates all prop guards as well as having the propeller flapping in all directions when you are trying to wind in a 20 mile an hour gale. The only real problem is attaching the tail boom and timer string with a fully wound motor. I developed an outstanding design of a clip arrangement for snapping the boom on which didn't work worth a darn. So I am back to lashing a rubber band on either side of the fuselage. The thin airfoil on the stabilizer appears to work well. I was trying to see how much I could reduce the drag and still maintain stability. The fin on the bottom seems to make the model want to go to the right under power. In fact the glide is to the left via stab tilt and nothing else. With zero side thrust the model flies alsolutely straight ahead even under full power. A small amount of right thrust will take her around to the right rather nicely. I experimented with an unheard of left power climb but the model never could get into a good left circle.

In the past few years I have learned a bit more about Pirelli rubber. In one instance, I found that a particular batch had higher "first wind" energy output than succeeding ones. A 14 strands motor, without break-in, had a higher torque value than a 16 strand motor with a break-in. Number of possible turns were identical, 525, with break at about 550 turns. Needless to say, the 14 strand motor was pretty well shot after one winding. — Test made with fish scale attached to handle of the winder and checked every 40 turns. — I now check every batch to find out if I can use it without any break-in.



DESIGNING SAILWING MODELS

John Worth Fairfax, Va.

Flex-wing, Parawing, Sailwing, Rogallo-Wing; they're all different name for the same thing — a super-simple aerodynamic concept with apparently great potential. The only reason for saying "apparently" is that there are many applications of the wing currently being developed, but none has as yet quite obtained the degree of success predicted for it. Still, we seem to be progressing rapidly on many fronts with flexible wings so that a fuller realization of promises seems to be just around the corner.

Those who are engaged in flexible wing research know how elusive turning that corner can be — despite much general effort in recent years, there is still a surprising amount of art involved. So, even though there is being gradually accumulated a considerable amount of data which is putting more and more science into the picture, right now there is still enough mystery to offer anyone a chance to become an overnight expert through practical experiment rather than slide rule manipulation.

Flexible wings are deceptively simple. Structurally, they are the next thing to a parachute in simplicity. Aerodynamically, however, they require consideration of a number of factors which must be carefully mixed together for achievement of a successful flying machine. The mixing process can become quite complex, for the factors interact to such a degree that many seemingly simple variations can produce complications entirely unexpected unless an appreciation is developed for what is involved.

One approach can save a lot of time, effort and aggravation. This is to accept a basic and proved configuration as a short-cut to learning principles and obtaining quick progress. This approach provides rules of thumb which can be easily applied for almost instant success. However, it should be kept in mind that there are many approaches and variations of the flexible wing concept and that there is a vast area of experimentation possible to progress beyond the basic configuration.

Let's dig right into the proved area. Take three equal length rods or tubes, join them all at one end by a common pivot to form an arrowhead, then spread the opposite ends fanwise so that there is a 45 degree angle between each pair. Thus, as shown in Fig. 1, you have the outer members 90 degrees apart — they provide the leading edges of the wing while the center member acts as a keel.

This arrowhead also provides the pattern shape for a cloth or plastic wing skin, or membrane. Simply lay the material over the wing frame and tape or glue it along the length of each member. Note that the material is straight across from the rear end of each leading edge to the rear end of the keel.

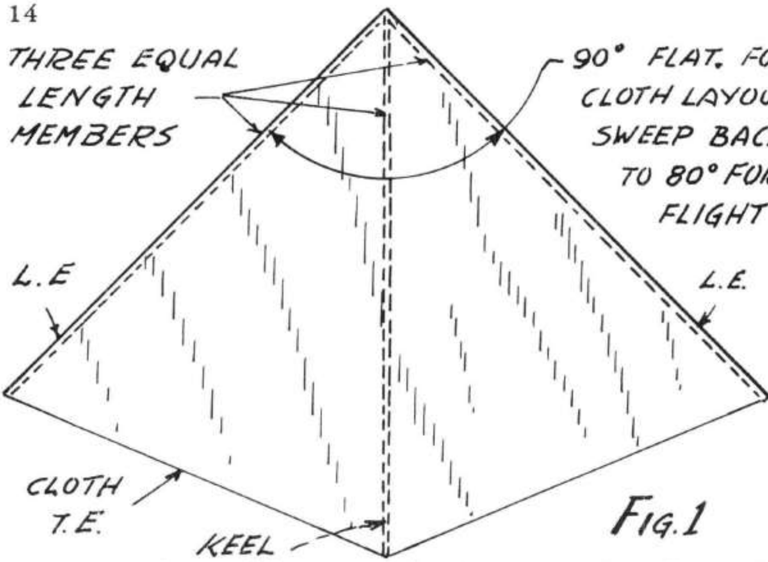


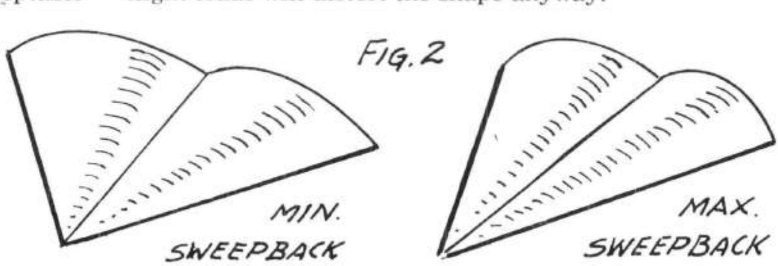
FIG. 1

What kind of materials are suitable for a typical model flexible wing ? For the frame, use most any kind of rigid tubing or rod — aluminum tubing or hardened dowel is good. What is needed is a good combination of lightness, rigidity, and strength (balsa is shy on the strength requirement). A rough guide for material size is to have a member diameter of about 1 percent of its length: for a 25″ long wing, this would be ¼″ dia. Vary to the nearest stock size according to the strength and weight available.

The membrane should be non-porous for best efficiency. There are many suitable plastics such as polyethylene; however, predoped silk, nylon or tissue can be satisfactory. Plastic films, however, are ready to use, cheap, easily attached and repaired with tape.

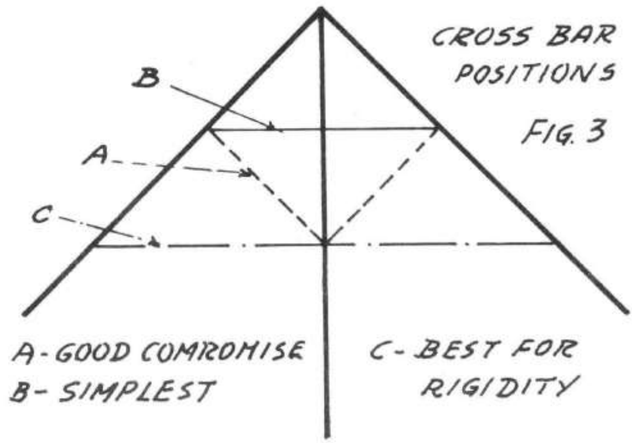
So far, we have described a flat wing, but it needs to be contoured for actual use, in order to provide stability. The leading edges should be swept back further from the flat layout positions so that the included angle between them is 80 degrees. This provides an optimum wing shape for both stability and lift — the more sweep, the greater the stability — but with reducing effective lift. The effect of increased sweep is to trade projected wing area for side area (see examples in Fig. 2). A couple of degrees either side of 80 are acceptable — flight loads will distort the shape anyway.

FIG. 2



MORE LIFT, LESS STABILITY LESS LIFT, MORE STABILITY

Some sort of cross-bar should now be added to maintain the sweep angle in flight. As indicated by Fig. 3, this can take several forms and may be located from ¼ to ½ way back along the keel — no need to go any further back. The bar can be of the same material as the wing members or of similar cross-section, perhaps even music wire, just so it is rigid enough to take compression loads — the wing will tend to squeeze together in flight.

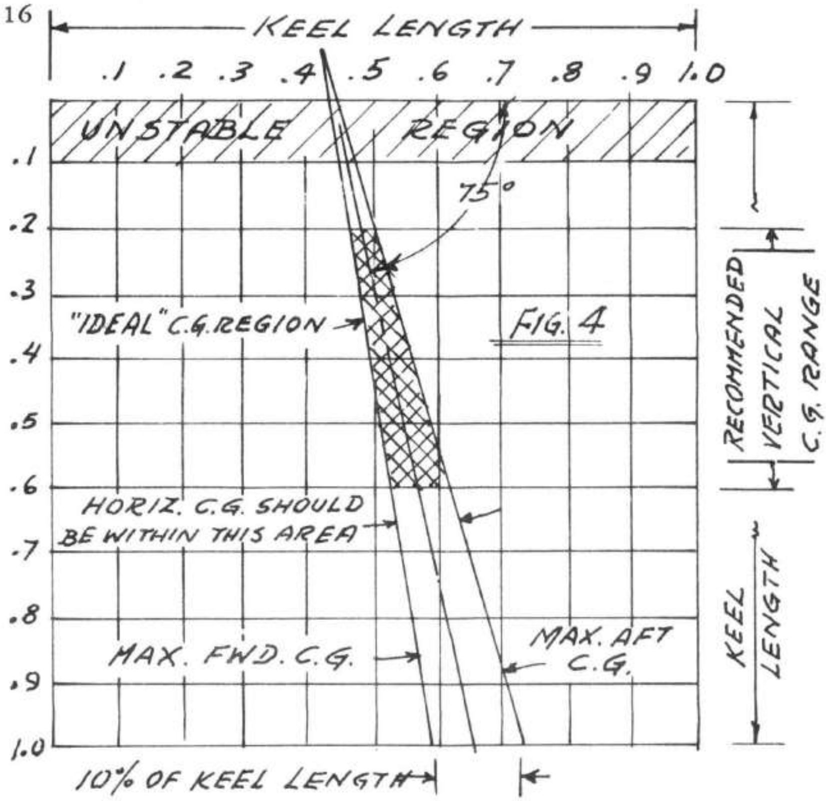


One important point: the distance between the keel and wing tips should be equal (at least initially), assuming a perfectly symetrical wing for straight flight. Small amounts of sweep angle differences can have great effect on model trim. In other words, it doesn't take much change in wing sweep, comparing one half of the wing with the other, to make a noticeable difference in turn adjustment— a couple of degrees difference is effective.

C.G. location is the key to proper flexible wing flight. Where conventional aircraft are concerned mostly with horizontal c.g. location, the flexible wing involves both the vertical and horizontal locations to a greater degree. To some extent, one can be traded for the other. Thus, a lower c.g. acts like a further forward c.g. and vice versa. Also, the vertical location has a great effect on stability and control.

The c.g. factors are shown in Fig. 4. The shaded area indicates the the desirable region of c.g. location for good trim. Note that a c.g. position near where the diagonal lines meet produces instability or lack of natural tendency for the wing to right itself when disturbed.

The desirable c.g. area is well below the wing structure — 20 percent or more of keel length below the keel. This means that some weight in structure or ballast needs to be carried below the wing itself. For the rest of the discussion, it will be assumed that you have some sort of framework or suspension system to provide the ballast below the wing frame. It should be at least equal to the wing weight (if in doubt, add more!). If the c.g. is too close to the top of the shaded area, it takes very little horizontal movement to change from nose heavy to tail heavy trim. This suggests two points: 1)



"KEEL LENGTH" BASED ON WING LAYOUT OF FIG. 1.
C.G. SHOULD BE AT LEAST 10% OF "K.L." BELOW WING.
"IDEAL" C.G. IS RELATIVE. COMPROMISE BETWEEN STABILITY & CONTROLLABILITY. (1/3 "K.L." BELOW WING, 1/2 "K.L." AFT, WITH WING KEEL HORIZONTAL.)

a high c.g. makes horizontal location critical. 2) a high c.g. makes for easier control since it takes less c.g. movement to obtain a trim change.

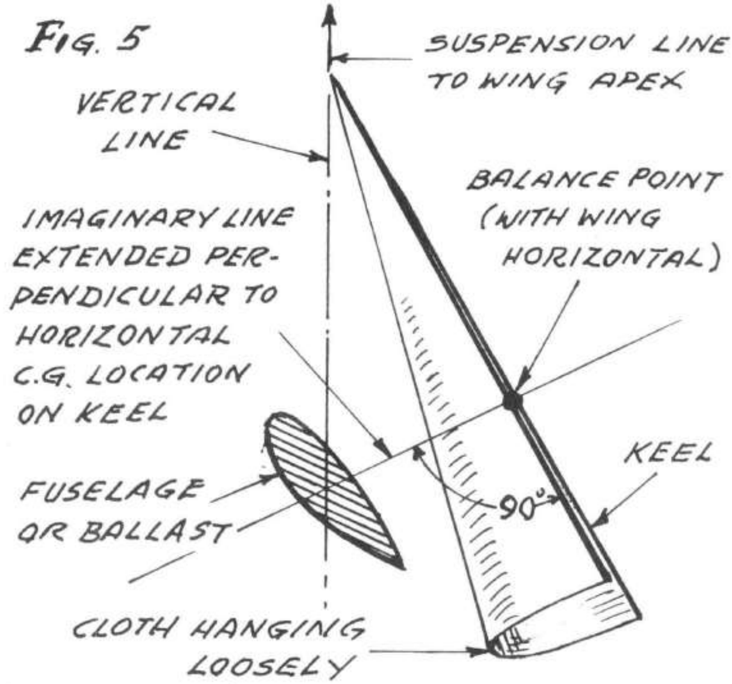
This, in turn, suggests that, for a non-controlled model (free flight), if the c.g. is kept well below the keel, adjustments are less touchy. How far below? It's not critical — from 25 to 100 percent of keel length is reasonable (in all such measurements, we are assuming that the keel is horizontal).

But, for a controlled model, too low a c.g. may require excessive control deflection or power — raise it to produce a more responsive control system.

To find the optimum point of control effectiveness, experiment with raising or lowering the c.g. But, to maintain pitch trim, remember to move the c.g. diagonally along the inclination line of the shaded area. This is necessary because raising the c.g. is also like moving it aft while lowering it is like moving it forward. So, your control system can either move the c.g. vertically or horizontally, or both!

<u>*How to measure c.g.:*</u> A simple method is to let the model be suspended right side up with the wing keel resting on your finger. Shift fore and aft until the keel is levelled horizontally and note the location. A good starting point for c.g. trim is to balance the model thus at 50 percent of the keel length — add weight or redistribute as necessary to obtain this.

FIG. 5



Remember that it is generally preferable to add any weight below the wing structure itself. How far below requires finding the vertical c.g. location. One way is to suspend the wing from the nose while noting where a downward extension of a vertical line from the suspension point intersects a perpendicular line through the wing keel balance point (see Fig. 5). The intersection should be no less than 10 percent of the keel length below the keel, preferably 25 percent or more. Adjust ballast by trial and error until the vertical c.g. location is acceptable.

Keep in mind that a little weight carried further down is just as effective as more weight not quite so low, so you may be able to get proper vertical c.g. without excessive total weight increase by either lowering existing weights or adding weight at the lowest point practical (example: heavier wheels or landing gear).

<u>*Glide testing:*</u> When you have the c.g. in the shaded area (of Fig. 4), hand glide tests of the model are helpful in providing final c.g. trimming. This is done just like with conventional models except that the large wing surface area and ungainly structure is trickier to handle. The launch must be made carefully, with as little angle of attack as practical — you need some positive angle to keep air

in the sail, but too much will result in ballooning or stalling. A number of gentle glides should be made until you are satisfied that the model has established its true gliding attitude. In a breeze, this may be tricky to determine because the drag of the model slows down the glide tremendously.

The true gliding angle at first may be a stall or a dive, depending upon the trim. The important thing is to be sure of what it is by several repeats, so as not to be fooled by the drag hiding the c.g. effect. It is often more satisfactory to hand-glide from a hill, so that the model has more vertical distance to settle into its actual glide path — but note that the glide of a flexible wing model is expected to be steeper than that of a conventional model; again due to drag. A gentle hill will minimize damage if trim is wrong; a steep hill will permit more vertical room for possible recovery. In any case, it helps to have tall grass to land in the first few tries.

Turn adjustments may be made in several ways. Moving one wing panel further outboard than the other will produce a turn to the narrow side (more projected wing area on outboard side, thus more lift). Wing tilt is another turn device. Either the entire wing may be tilted in relation to the fuselage or ballast, or the weight below the wing may be offset laterally to produce a side c.g. shift. One other trick, which is effectively the same as wing tilt, is to raise one wing tip or lower the other, or both.

Power tesing: In general, flex wings fly conventionally under power. The glide, however, is much steeper — like a conventional airplane with flaps down. This suggests that engine control may be used very effectively as an elevator or altitude control. Landings are best made under partial power so as to produce a conventional approach angle.

It is very practical for powered models to be trimmed by means of R.O.G. trials. In this case, it is wise to deliberately start out with excessive nose heaviness, so that a number of normal power takeoff attempts may be tried while gradually adjusting c.g. rearward and/or upward until the model lifts off gently.

During such takeoff trials, it is desirable to have the landing gear angle set so that the wing nose is inclined up slightly from horizontal; just enough to billow the wing cloth in a gentle breez or under normal forward speed in calm air. The model may be expected to lift off very quickly as the comparatively large wing develops tremendous lift when inflated.

With radio control, after the model is trimmed satisfactorily for flight, you may find it desirable to change the landing gear angle so that the wing stays at a negative angle on the ground until you give sufficient "up' to let the wing fill with air. The result is a non-lifting takeoff run to build up air speed, then a jump type takeoff!

A very important factor in takeoffs is landing gear alignment. With a great wing area comparatively high above the c.g., the model can easily be blown over by a gust of wind. It is very helpful to make several hand-pushes of the model (power off) directly into the wind, to determine tracking of the gear — the model *must* roll straight. An alternative, very desirable but an added complication, is to provide a pivoting type crosswind gear so that the wheels are free to trail freely even if the wind force on the wing blows the model sideways. The model then simply slides sideways as it takes off. Crosswind gear or not, four wheels are better than three, preferably with as much distance as possible between each pair laterally.

The rear wheels of a tricycle or quadracycle gear should be just behind the c.g., while the front wheels of a conventional two-plus tailwheel setup should be just forward of the c.g. In all cases, these arrangements permit easy rotation of the model in pitch during takeoff. Also, as mentioned previously, it is desirable for final model trim, to have the normal ground angle of the model set up so that the wing is at a negative angle. This is particularly important for landings so that, when the model touches down, it will kill the wing lift and prevent ballooning. With the comparatively large wing surface, the area exposed to wind can cause the model to be blown over if the lift is not dumped upon touchdown. This again favors a three or four wheeled gear as it is difficult to do with a tailwheel setup.

Hand launching a powered model is a little special. It mainly requires that the model be held in a side-tilted attitude with the nose slightly up. The idea is to let the wind blow into the bottom of the wing to hold the cloth inflated as the model is launched. Thus, the model is not launched directly into the wind, but just to one side. One or two-handed, the launch is like that for a hand-launched glider except that no great shove would be given. (This may stall the model.) There is a great lift available so a smooth easy launch is all that's usually necessary and the wind, if any, should be coming from your shoulder opposite the one nearest the model.

Engine thrust adjustment is all important. Ideally, it should pass right through the c.g. In some configurations, especially where the c.g. is considerably below the wing, the angle of thrust to wing member can produce a strange appearance. If the thrust line is very much off c.g., it can make for wild flying. For example, if the trust line passes much below the c.g. when the model is level, this produces a nose-up moment. This might not be bad except for the fact that, when the model rolls over into a bank, the nose-up moment wants to tighten the turn. In the case of a nose-down movement, the thrust tends to oppose a banked turn. Side thrust similarly can cause weird effects on pitch trim during rolls or banks. These actions are present in conventional models also, but with the typical flex wing, the c.g. is usually so far away from the center of drag that the reactions are multiplied much more than normal.

Control systems used to date have been of the weight shift and airflow deflection types or combinations of both. With weight shift, the mass below the wing is moved so as to displace the c.g. This is the brute force concept which is very simple but requires powerful control means. Air deflection uses conventional aircraft control surfaces which, when moved against the airstream, produce airload forces to push the model around.

Performance: The flexible wing model is capable of quite violent maneuvers. For instance, vertically banked figure eights, even loops, are easily achieved. But, there is a serious limiting factor that must be watched. The wing acts like a wing only so long as it maintains lift. Just like a sail on a boat, when the cloth luffs or loses its lift, it is just a limp rag. Thus, if the model should completely stall so that the mast drops to vertical and lift is lost, the model can be expected to tumble end-over-end or dive straight on down! Fortunately, this condition is not too easy to achieve and, in some cases, must be deliberately provoked, so it is usually easy to avoid.

All the foregoing may cause one to wonder why bother with flexible wings at all. The answer to this lies in the great sense of achievement and satisfaction that results from flexwing flight. The wing, all billowed out, is as graceful as that of a sail on a boat. The resemblance to a serene gull riding the air waves is immensely appealing. Also, the wing is new enough that the appearance of one on the flying field has tremendous crowd appeal. A flexible wing flying model is little more than a cordless kite and the attraction is magnetic.

The achievement of turning a rag and stick structure into a smooth flying machine has an inherent magic all its own. In addition, the wing is light, cheap, stable, has tremendous wing area for wingspan. It is easily folded for simple transportation and easily repaired. The only way to prove it is to try it yourself and the simplest way of all is to merely replace a conventional wing with a flexible wing of equal span. The simplicity of construction makes easy a quick try so that getting to the flight test stage is a snap. Yet, the intricacies of trim and the new learning involved provide a challenge that offsets any "it's too easy" attitude so that successful flight is an achievement nobody need sneer at.

CHECK ON 6° ANGLE OF ATTACK — Byron Webber

After reading the 1951-52 Year Book, I built a probe on an eight foot glider to measure the angle of attack. I photographed the probe in slow motion in flight. Sure enough, it said SIX DEGREES at the best glide angle. I was looking at these films not long ago. It does not seem like ten years have passed since they were made. Anyway, it made me take a very close look at the rest of your work at that time and I have been a believer ever since.

As to the delay in studying your CIRCULAR AIRFLOW; I have been involved in the final stages of design of my full size home built plane. From the aerodynamical point of view, the full sized light plane is simpler than a free flight model. Structurally it can be a real engineering task.

R/C DOUBLE DELTAS

Bill Poythress Saugerties, N. Y.

It all started in 1949 when we used to fly models at lunch time. Lack of storage space for larger aircraft and time to eat lunch and fly models, forced us to fly hand launched and catapult gliders. We tried to develop a catapult glider that would go way up, circle tightly and not stay up too long. If a ship did pick up a thermal, the lack of time eliminated any chance of chasing it. I thought that a Delta configuration might be just what we needed.

During this time I came across some data and descriptions of Delta wind tunnel models which were tested in Nazi Germany. This data intrigued me. I thought if I built a Delta planform catapult glider, I could get good altitude, and because of probable high sinking speed, would not experience too many fly-aways.

The first model had a 12 inch span with a 12 inch center chord and 36 square inch area. Figuring about 2/3 of this area as effective lift, I had 24 sq. in. of wing and about 12 sq. in. of horizontal stabilizer. The wing was made of 1/4 in. sheet, but cemented and sanded down to an approximate air foil shape. The fuselage was a piece of yard stick 24 inches long, 6 inches of which extended forward of the wing apex to supply some forward side area and a place to put clay. The fuselage tapered to about 1/4 x 1/4 at the tail end and had a triangular vertical stabilized cemented to the top of it (Sketch #1).

Subsequent test gliding showed the need for warping the trailing edge "up" to obtain stability on the pitch axis. After many "on and off" of the clay, I discovered that the C.G. position on this configuration is very critical, as little as 1/4 inch forward or aft of the 50% chord point was enough to drastically affect pitching recovery. By this time I felt I was ready for a catapult attempt. Trimmed for a tight left circle in the glide, the ship was launched with an extreme right bank at about a 45° launch angle. The climb was spectacular with a beautiful roll out and the glide far exceeded my expectations. (I lost it in a thermal, still going up after 15 min.).

Five more catapult gliders were built, all had the same area, but with different chord to span ratios (or L.E. sweep angle). The basic construction however, remained the same. The problem of accurate C.G. location remained regardless of the L.E. angle. No attempt was made on these gliders to do much with the air foil. (After all there isn't much that can be done with an air foil with a 1/4 inch maximum thickness with such long chord lengths.) One lesson was learned (or assumed), and that is that the mean chord line (a line drawn equidistant from the upper and lower surfaces) had to have a reflex in it (Sketch #2). This was obtained in the sheet balsa wings by warping the trailing edge up.

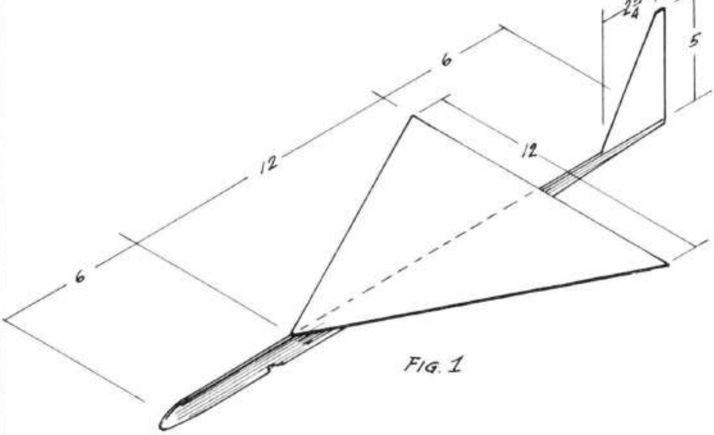


FIG. 1

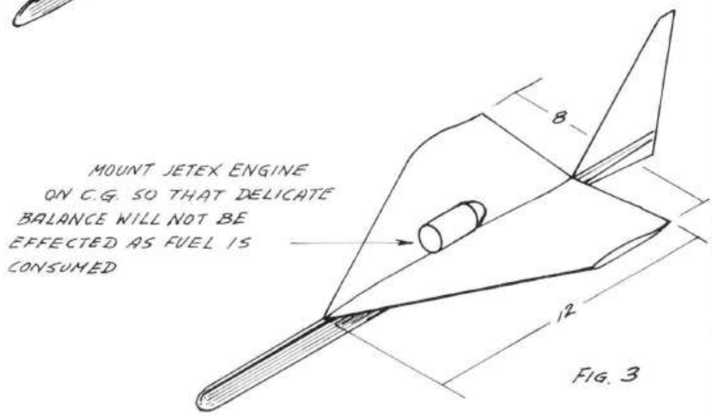
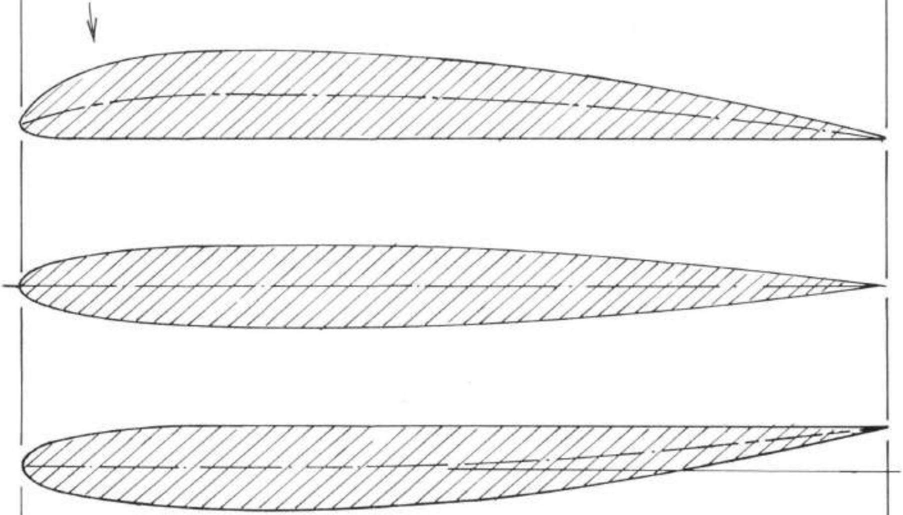


FIG. 3

FIG. 2



The next experiment was to put a newly acquired Jetex "50" unit on one of the existing catapult gliders — the glider proved to be very sluggish under this power. The assumption was made that it (the glider) was too large and heavy for this small rocket. Then the real trouble started — here was the ideal situation for extreme lightness with adequate strength — short span — large chord — practically negligible bending and twisting loads to worry about. But how do you build such a thing? My design parameters were as follows:

Wing Area — same as glider (24 sq. in. effective) Span — 12 in.

Chord — 12 in. (center) Built-up and tissue covered.

The airfoil should have a reflexed chord line. The wing (due to its planform) must also have a taper in thickness from max. at the root to a theoretical zero at the tip. I started to draw up such a wing — I picked one of the N.A.C.A. reflexed airfoils as being a close guess. Rib spacing at 2 inches with multi-spar construction seemed about right. However, when I got down near the tips, I ended up with a bundle of spars and no room left for a rib. So the misshaped area at the tip (2 inches) was chopped off. This looked rather weird to say the least. To make a long story short, I built it anyway — using solid ribs cut from 1/16 sheet with a piece of 1/8 sheet placed in between the root ribs for a fuselage. (Sketch #3).

The glide tests looked rather promising, fast, but quite flat with a rather low sinking speed. Trimmed for about 100 ft. diameter circles, I was ready to try power. The first flight was a real humdinger. The fuse was lit, a straight out launch, and as soon as the fuel took hold the ship zoomed straight up and over on its back to make the prettiest round loops you ever saw. After three nice loops, the fuel was exhausted and the ship made a beautiful 1/2 roll on top of what would have been the fourth loop. The glide was exactly as it should have been. The next question, obviously, was how to eliminate the looping without destroying the nice glide pattern. After about 50 flights, I finally was getting consistent climbing turns with a good transition and glide. (A knowledge of the circular airflow theory would have been a great time saver.) By this time the model was a little worse for wear.

I was by now anxious to try out some other ideas that were kicking around in my head. One idea which kept nagging me was a tandem or canard. (I never saw a tandem Delta but the B-70 is a Canard Delta.) The reason for choosing this configuration was to attempt to reduce the fussiness of the C.G. location. This persistent idea was constantly resisted because I felt that if I strayed from a pure delta, I would somehow be betraying my goal. I finally compromised with what is known as a Double Delta. In reality, this planform is a low aspect ratio Delta superimposed on a higher aspect ratio Delta. The actual proportions I ended up with were arbitrary, but the air plane looked reasonably well on paper and dimensions were easy to remember. (Needless to say, this article is not a scientific treatise.) See Sketch #4.

Now that the basic aircraft proportions were established, I decided to build a small engine (Cox .020) powered ship. This decision re-introduced the problem of how to build a model.

The first step was to make a full sized outline drawing and then figure out how I would fill it up with structure. Half a plan view was layed out following the proportions shown on Sketch #4. To layout the side view, a full sized airfoil had to be drawn. While doing this, an idea came! Why not use spanwise ribs and connect them with chordwise cap strips just as I connected the points on the airfoil curve with a spline? This would eliminate the necessity of plotting a series of conventional ribs, however, the spanwise ribs or spars had to be individually drawn up very accurately. So I decided to build up these members of strip stock thereby making them lighter. If I built them in place they would fit perfectly without having to draw them individually. So I started with a central rib cut from 1/8" sheet. This rib was pinned inverted to my workboard. (Sketch #5). The outline was made up of 1/4 sq. with a piece of 3/16" x 3/4" for the trailing edge. The central rib was previously marked off and notched every 2". The bottom piece of each spar was first put in place, then the assembly was removed from the board and the top member and braces were put in. The nose blocks were tack glued in place so that they could be removed later and hollowed out. After the spars were all put in, the trailing edge was marked off with 1" spacing and the cap strips were all put on (top and bottom) except the one nearest the center on each side. The engine mount was then glued into position and the remaining cap strips put on. Now I had something that looked right! It was light and even without covering was very rigid. Sandpaper faired the outline and trailing edge and the vertical fin was cemented on.

The whole assembly was covered with Japanese tissue and doped. After mounting the engine and checking the balance I was ready to test glide — When, another problem reared its ugly head! There was no way to get a good grip on the model! Using a piece of 1/8 sheet with the lower rib contour cut in it, I cut a keel and cemented it to the bottom of the airplane. The flight tests of this ship showed the design would have excellent promise as an R.C. ship. The power-on portion of the flight was very fast with a good transition into a fast, flat glide (too fast to respond to thermals).

Seven different models were built, all powered by the same engine, all with the exact same proportions. However, each had a different airfoil section. The airfoils ranged from the rather thick N.A.C.A. section used on the first of the series to a very thin (5%) section. The airfoil which was the most successful was a real odd-ball, starting with the first 30% of a 10% symetrical section, a line parallel to the center line was drawn tangent to the upper surface. Then using a spline the lower surface was faired from the last point on the symetrical portion to the traling edge. Tests showed that this section flew at about 6° angle of attack. With 8° down thrust, nice consistent flights were obtained.

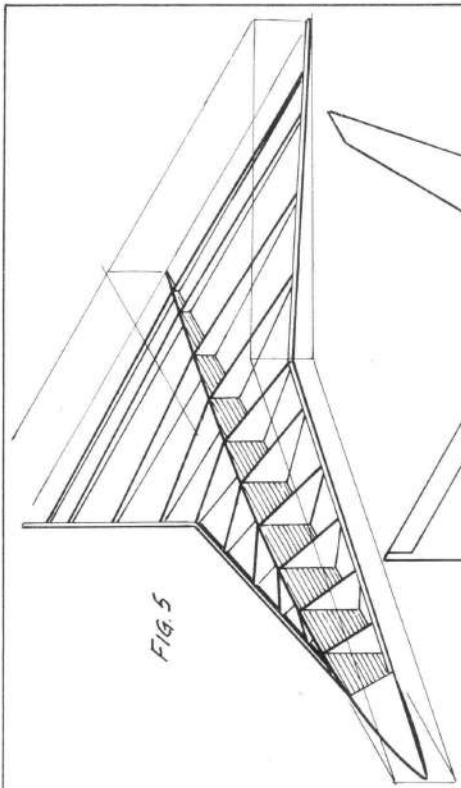


FIG. 5

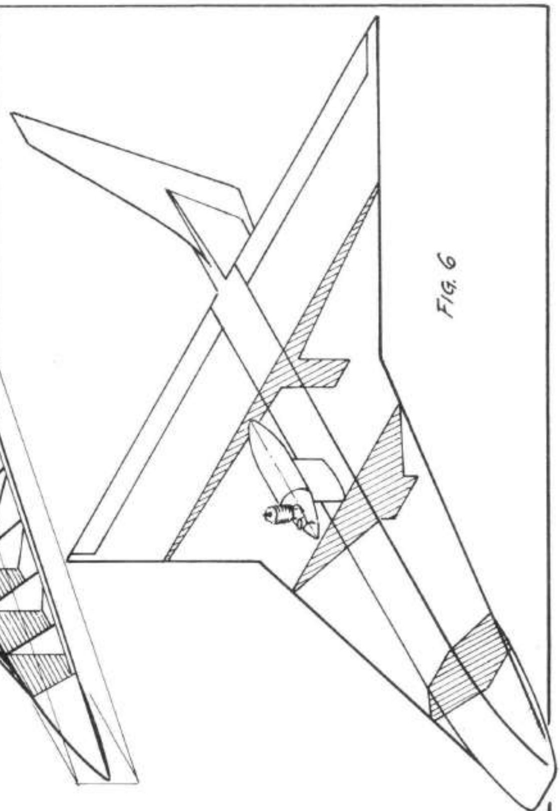


FIG. 6

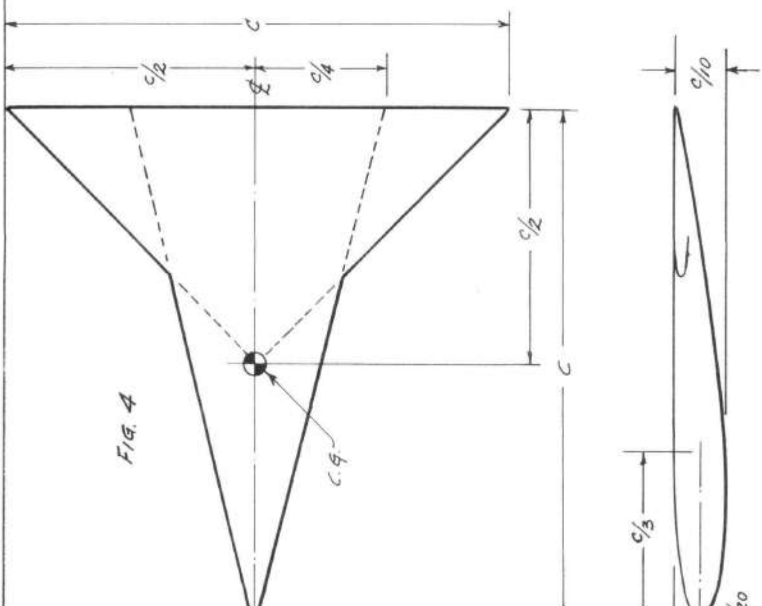


FIG. 4

The next model was a small, fast R.C. ship. Using the same basic dimensions and airfoil section. The layout was made using a 20 inch max. chord.

Instead of a flat keel, this ship had a fuselage which contained the radio equipment. While still on paper, a two inch wide section was sandwiched between the wing halves, this fuselage portion used the root airfoil as its sides with a faired in Vee bottom which terminated at the rudder post. It was powered by two .020 engines placed back-to-back on the same pylon with a common fuel tank between them. The radio equipment consisted of a Control-Aire single channel C.W. receiver which operated two flyball actuators. One actuator motor was connected to the N.O. relay contact. This allowed the motors to vary speed proportionally as the pulse length varied. As the pulse frequency varied, the motors would speed up or slow down in unison. Each actuator linkage was directly connected to an elevon (there is no direct mechanical connection between elev ons). (Sketch #7)

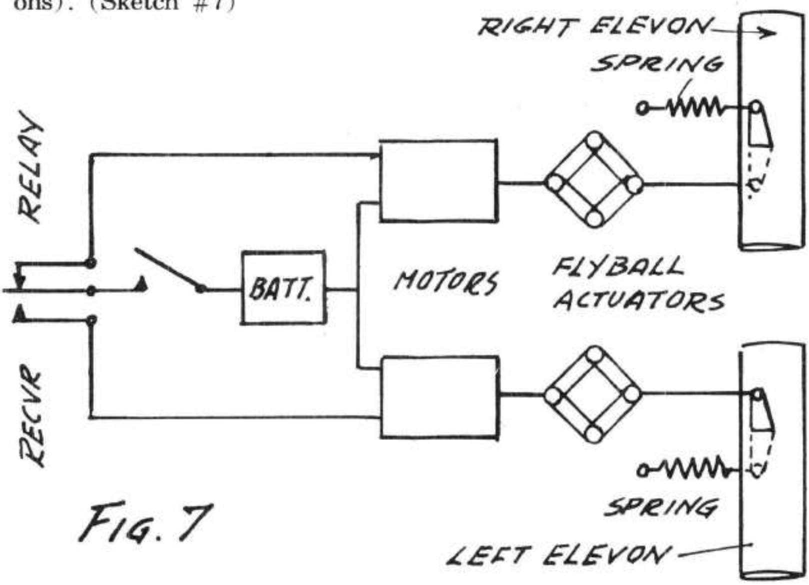


FIG. 7

The control system worked very well. To make a turn, the control stick was moved in the direction of the required turn. The resulting pulse length change causes one motor to slow down and the other motor to speed up, this in turn moves one elevon down and the other elevon up. The airplane will start to roll. When the airplane has rolled the right amount, the control stick is centered and then pulled back. This causes the levons to neutralize, then as the stick comes back, the pulse rate decreases causing both actuator motors to slow down thereby moving both elevons up by the same amount. The end result of all of this is a turn, the quality and severity of which depends on how much practice you've had. Some speed runs were made (using a fixed distance and stop watches). The results of these runs were truly amazing. We consistently clocked speeds in excess of 70 m.p.h.

Using a pulse system to control Deltas made it susceptible to interference. And while flying one day at an estimated altitude of 500 feet, a spurious signal was picked up which was decoded by my receiver to be "Full On". This caused one elevon to go to extreme "Up" and the other to go to extreme "Down". The airplane, needless to say, was completely demolished. A fail-safe system was devised by the simple means of connecting the one control linkage to a control horn on the upper side and the other to a horn on the lower side and rotating the control box in my hand 90°. Now I had reversed the pulse operation so that by changing the pulse length I got pitch control and by changing the pulse frequency I got roll control. At this time I also increased the control surface movement to about 60° each way. Subsequent flight tests proved the validity of these changes. After gaining plenty of altitude, the "Full On" button was depressed and held. This simulated interference. Both control surfaces went to the extreme up position and due to the large angle acted as a dethermalizer, the model slowed up at once and settled (motors running wide open) very nicely and undamaged to the ground. For the next test the "No Signal" button was depressed and held. The airplane's nose went down and the ship continued into what normally would have been an outside loop, but due to the drag of the high angled control surfaces, it settled down as before only inverted.

Due to the pressure of other things (and lack of "contest fever") no meets were entered. I believe that this configuration and control systm has what it takes to place high in pylon racing and possibly F.A.I. speed trials. You will notice that no mention was made of a landing gear. The reason for this is quite simple. I don't believe in hanging this useless (to me) dead weight and drag on a nice clean design. However, if you feel that you must have a take-off gear (realistic nomenclature) a tricycle arrangement would be easily mounted and wheel brakes could easily be tied directly into the control linkage.

WINDY WEATHER AIRFOILS

Nat Antonioli

Flying near the Coast we (San Diego) get a "mixed bag" of wind conditions. Most of the time we have calm from early morning till 10-11 A.M. After this, the wind picks up to 15 mph plus, usually with quite a bit of turbulence. Airfoil #1 seems to be the best under these conditions (as well as for indoor). See Pg. 162

However, during the winter and early spring months, when we have most of our rain here in So. Cal., the winds are high but usually steady with a lack of turbulence we encounter in the summer and fall months. Evaluating both airfoils we found airfoil #2 to be superior particularly as far as stability is concerned, under these conditions, plus greater penetration on launch.

The amount of lift generated, comparing one airfoil with the other, outdoors, is largely academic. Stability is more important, outdoors, with a H.L. glider. Outdoors one has to design for the particular environment we fly in. I am sure most of the Free-Flighters recognize this fact. — I believe airfoil #1 has better stability under most turbulent conditions in that the upper boundary layer may stay attached longer due to the sharp L.E. and high point.

CHARACTERISTICS OF TURBULATED AIRFOIL

Harry C. Shoaf Melbourne Beach, Fla.

The design of an airfoil for a fullscale aircraft is not a very difficult task when one has the proper NACA reports to refer to. Indeed, there is really no need to design one since the tremendous research by NACA has produced hundreds of sections, some of which must surely fit the characteristics sought by the designer.

The modeler, on the other hand cannot make good use of these reports when seeking an airfoil for model application. The principal reason for this is because of the differences in "Reynolds Number," between full scale and model size sections. Factors which affect Reynolds Number are basically:

A. Size of the body
B. Velocity of the body thru the fluid, or air, in this case
C. The viscosity or "thickness" of the fluid compared to the body size.

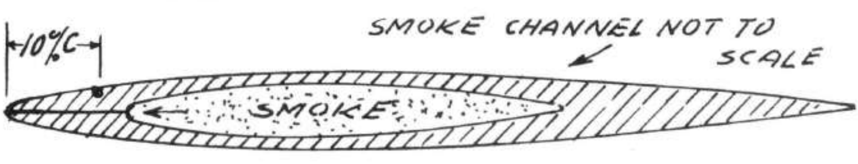
To illustrate, we may scale down the size of a full scale aircraft as well as the speed, but we cannot scale down, or thin out the air it flies in. This remains constant. As an example, suppose we use a thirty foot power boat, traveling at thirty miles per hour. A two foot model of this boat traveling at the scale speed of two miles per hour would not show a bow wave or a wake of the same configuration, as the large boat, nor would it produce the foamy characteristics of the full scale wave. The small scale wave would be more like a clean curl of water, free of foamy disturbancies. In other words, the water of the model is just not thin enough to be similar in behavior to that of the full scale boat.

Model aircraft have the same sort of problem with air, and should employ airfoils designed for the lower speeds. This is where the real modeling problem arises because very little research has been done in the model speed ranges.

A few years ago the author embarked on an ambitious program to resolve model airfoil problems by trying to establish low Reynolds number criteria for airfoils in a systematic manner. To achieve this end, a tunnel was built with smoke capability as well as a force measuring balance. Smoke studies were made while the balance system was being built. Just when the balance system was about to be utilized, the author became too involved with Project Mercury to continue. However, a sufficient amount of work was done so that criteria was beginning to emerge. No attempt will be made to discuss these efforts here; however, some of the investigations made on turbulators will be presented.

The flow about an airfoil, because of its low Reynolds number range is essentially laminar. A characteristic of low speed laminar flow, at modest angles of attack (α) is that the laminar flow separates easily from the body. This is especially true of highly cambered sections and blunt leading edges. A turbulent boundary layer flow on the other hand tends to remain attached. If the flow can be made to become turbulent in the boundary layer, the flow field over the section will remain attached over a higher α range. The reason for the higher α capability is two fold. First, turbulent boundary layer prevents the reverse flow beginning at the trailing edge of the top surface from moving forward, and wedging off the flow as the α is increased, because there is little or no dead air at the surface of the body. It is all in motion. Second, the turbulent action ties in the stream lines so that an immediate velocity gradient exists between the airfoil surface and the free stream. With laminar flow the reverse is true. The gradual velocity gradient from zero at the surface to free stream velocity plus reverse flow, easily splits the flow which results in separation or as we say the stall. The question may arise at this point as to the possibility of increased drag of a turbulent section over that of a laminar one. The answer is yes. However, when one examines the whole picture, the reverse is true.

The section selected as the tunnel model was a basic symetrical airfoil evolved by the author and designated as the epsilon 0049. It features a sharp leading edge, has a 9% thickness at the 40% chord location. The model was hollow and built of brass. Smoke was introduced into the hollow section and allowed to bleed out thru a spanwise line of pin holes at the leading edge. This was done so that the smoke would flow in the boundary layer. (Smoke will not properly get in the boundary layer if introduced upstream external to the body.) The model was built with a slot located at the 10% chord position which received a turbulent insert blade which could be raised or lowered to a flush position remotely. A number of blades were made with the top edge shaped to produce various turbulator configurations. Before proceeding one must understand that the flow over a flat plate or mildly curved surface at zero or low α will begin as a laminar flow. After some distance, depending on Reynolds number the boundary layer will become unsteady for some distance. This unsteady flow is termed the transition region, and is probably caused by an adverse pressure buildup. The transition becomes more unsteady and finally becomes turbulent as it moves over the airfoil. So we really have three types of flow over a surface provided it is free of turbulances. The figures that follow depict the extent of laminar, transition, and turbulent flow chordwise at 1° increment of α. Also, the thickness of the turbulence at the trailing edge is shown at right hand side of the figure for the corresponding α. The thickness of the boundary layer at the trailing edge may be thought of as a measure of drag for that section when compared to other configurations under the same test conditions.

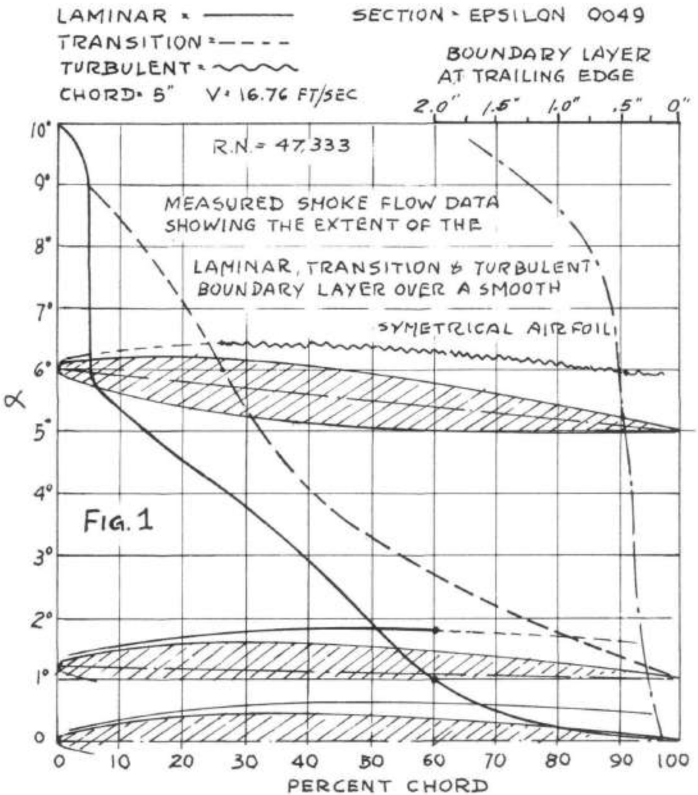


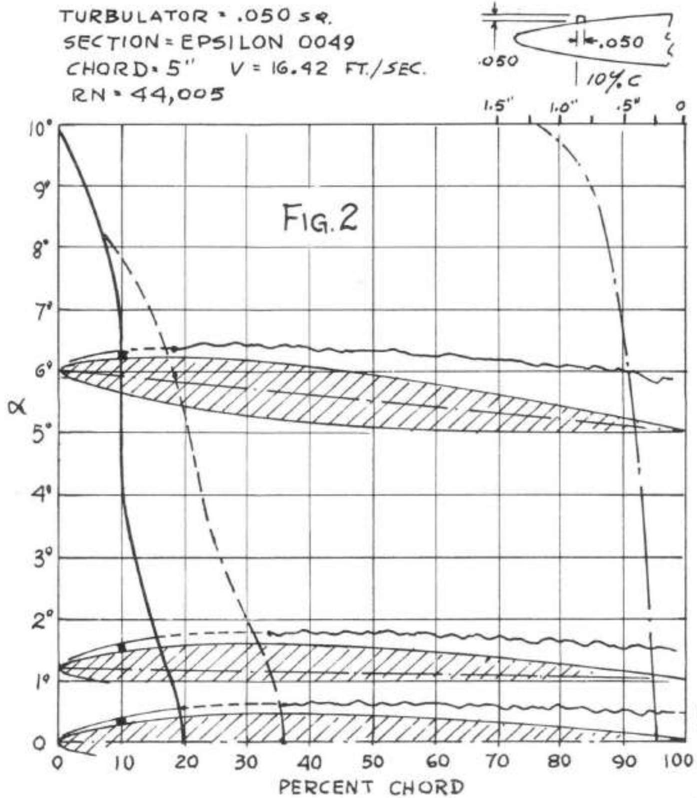
The smooth non-turbulated configuration was tested first to establish its basic flow characteristics and to measure the extent of the laminar, transition, and turbulent flows. Fig. 1 shows the result. At zero degrees α the flow is laminar for the entire airfoil length. At one degree α it is laminar to 60 percent chord and the transition flow extends from there to 100 percent. As the α is increased to two degrees the turbulent flow begins to form. As the α is increased to six degrees, the laminar distress is steadily decreased to the five percent position where it remains constant until separation at about nine degrees α. Note that the boundary layer at the trailing edge increases slowly to about eight degrees α where it sharply increases. This high increase always occurs just a degree or so prior to the separation of the flow. The flow at six degees was of particular interest because this α was established during an extensive glide program as being the α at which a gliding model of the Wakefield category operated at optimum trim. Dragwise, the boundary layer height at the trailing edge is precisely one half inch at six degrees α. When one examines the other figures at the six degree α, the measured data clearly shows that adding turbulators of the type tested does not increase the drag. In fact some show a decrease.

One further comment on Fig. 1. At one, two and three degrees α a reverse flow was noted on the surface under the laminar flow. It began at about 50% chord and moved slowly forward and outward to about the 30% chord point. It appeared to be a dead air region which disappeared at four degrees α. This pocket or bubble phenomena was repeatable on the smooth configuration and could not be found on the turbulated section tests. The author had heard this bubble phemomenon before while using a stethoscope and listening to boundary layer noise during low speed testing in the NACA cascade tunnels.

Broadly speaking of the five types of turbulators tested, three were of a continuous two dimensional design. That is they were either square or triangular in cross-section and solid when viewed from the front. The other two, when viewed from the front were a sawtooth shape and a castellated shape. This type is really a vortex generator in that the air flows around and over in a three dimentional manner. There is a difference between the two categories as the figures indicate. One unexpected result was that the extent of laminar flow with the vortex generator is half that of the turbulator and in fact begins to transition before it reaches the vortex generator, see Figures 5 and 6. Above four degrees α the transition region disappears altogether and the flow becomes turbulent from laminar immediately. No reason for this behavior will be put forth as yet.

These turbulator tests also included smoke lines introduced upstream to observe the flow field above and below the section while extending and retracting the turbulator. It was general tunnel practice to center one of the smoke lines at the stagnation point. When the turbulator was raised it was noticed that the smoke line was no longer at the stagnation point. Experimentation showed that the


LAMINAR =
TRANSITION = - - - -
TURBULENT =
CHORD = 5" V = 16.76 FT/SEC
SECTION - EPSILON 0049
BOUNDARY LAYER AT TRAILING EDGE
2.0" 1.5" 1.0" .5" 0"
R.N. = 47,333
MEASURED SMOKE FLOW DATA SHOWING THE EXTENT OF THE LAMINAR, TRANSITION & TURBULENT BOUNDARY LAYER OVER A SMOOTH SYMETRICAL AIRFOIL
FIG. 1
α
10° 9° 8° 7° 6° 5° 4° 3° 2° 1° 0
0 10 20 30 40 50 60 70 80 90 100
PERCENT CHORD


TURBULATOR = .050 SQ.
SECTION = EPSILON 0049
CHORD = 5" V = 16.42 FT./SEC.
RN = 44,005
.050
.050
10% C
1.5" 1.0" .5" 0
FIG. 2
α
10° 9° 8° 7° 6° 5° 4° 3° 2° 1° 0
0 10 20 30 40 50 60 70 80 90 100
PERCENT CHORD

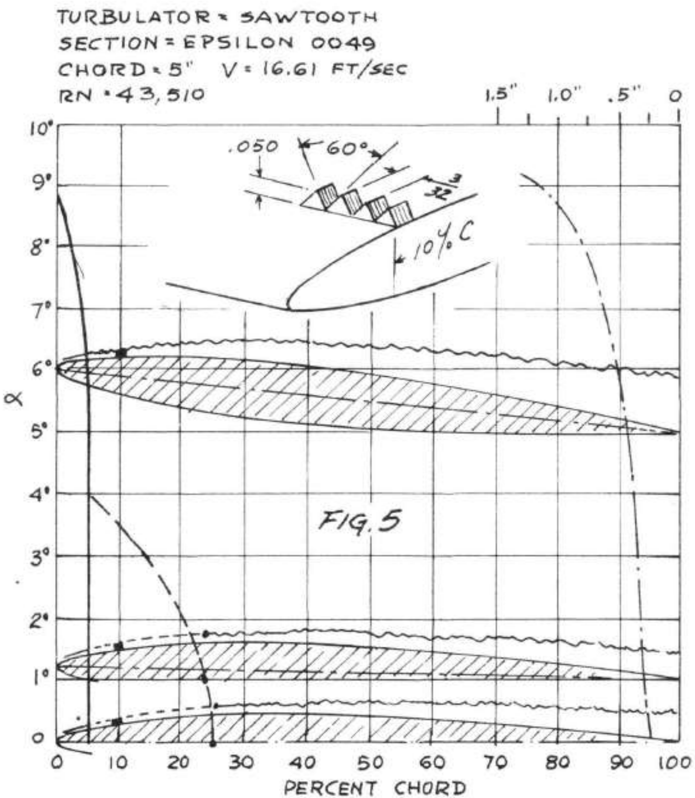

TURBULATOR = SAWTOOTH
SECTION = EPSILON 0049
CHORD = 5" V = 16.61 FT/SEC
RN = 43,510
1.5" 1.0" .5" 0
.050
60°
3/32
10% C
α
10° 9° 8° 7° 6° 5° 4° 3° 2° 1° 0
0 10 20 30 40 50 60 70 80 90 100
PERCENT CHORD

FIG. 5

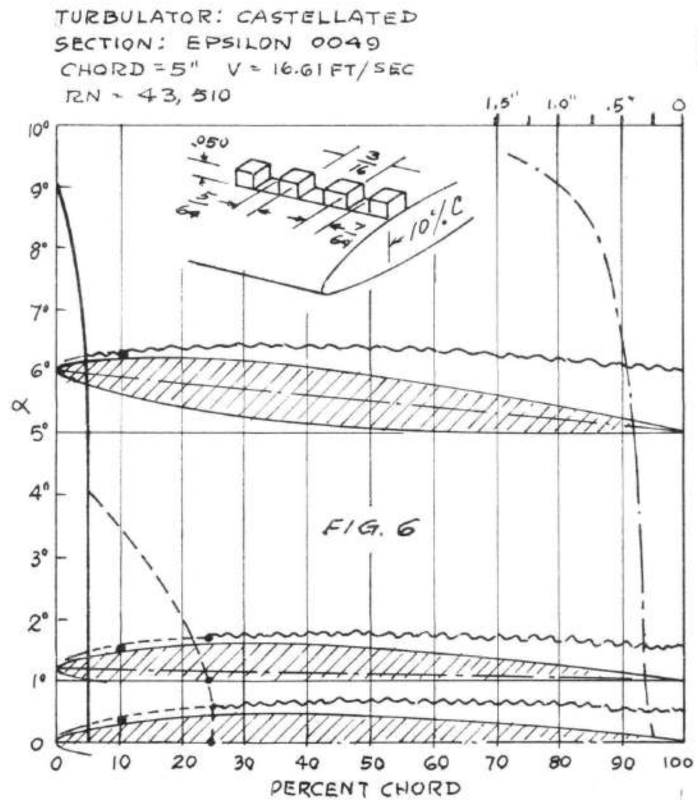
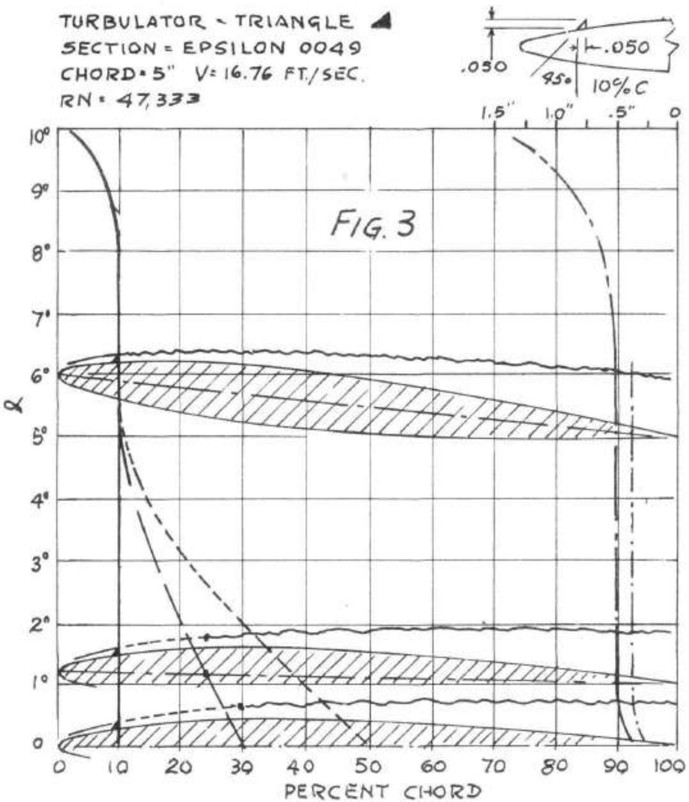
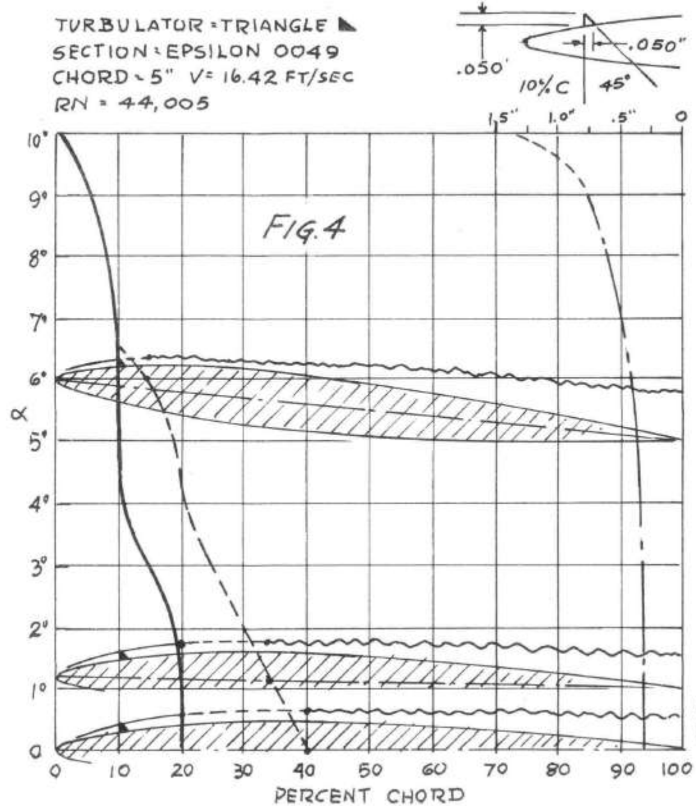

TURBULATOR: CASTELLATED
SECTION: EPSILON 0049
CHORD = 5" V = 16.61 FT/SEC
RN = 43,510
1.5" 1.0" .5" 0
.050
3/16
5/64
7/64
10% C
α
10° 9° 8° 7° 6° 5° 4° 3° 2° 1° 0
0 10 20 30 40 50 60 70 80 90 100
PERCENT CHORD

FIG. 6

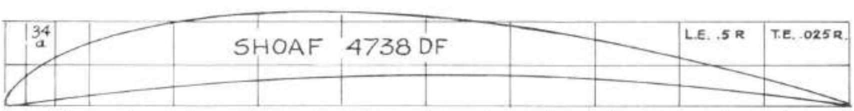

TURBULATOR - TRIANGLE
SECTION = EPSILON 0049
CHORD = 5" V = 16.76 FT./SEC.
RN = 47,333
.050
.050
45°
10% C
1.5" 1.0" .5" 0
FIG. 3
α
PERCENT CHORD


TURBULATOR = TRIANGLE
SECTION = EPSILON 0049
CHORD = 5" V = 16.42 FT/SEC
RN = 44,005
.050'
.050"
10% C
45°
1.5" 1.0" .5" 0
FIG. 4
α
PERCENT CHORD

stagnation point moved aft whenever the turbulator was raised at any given α. Since the stagnation point will move aft as α is decreased, the effect of a turbulator seemed to be that of operating at a lower α than the airfoil was positioned to. One might conclude from this that turbulators increase L/D for a given α. The amount of increase of course can only be determined by testing with a balance system. Should the skeptic doubt the performance of turbulators let him perform a simple experiment as follows: Using a model such as a Wakefield, Nordic, etc., stick a 1/32-1/16 square strip of balsa at the 10% chord location of the stabilizer with rubber cement. Trim the model for a good hand launched glide. When finally satisfied with repeated glides, remove the turbulator and watch it stall.

Preliminary testing to the investigation presented here indicated that a turbulator height of about .050″ seemed optimum for the chord speeds used. Figure 3 shows a dashed line at the transition to turbulent interface and another showing the boundary layer thickness. These data are the results of the triangular turbulator at a height of .025 inches or half the height of the rest of the curves. Note that the length of the transition flow in linear with the height of the turbulator and that the boundary layer is somewhat less at the trailing edge. One must not assume however that a smaller turbulator will work on other airfoils satisfactoritly. Further investigations will have to be made before the whole picture is known.

The tunnel status is fairly good. It is now reassembled and I am working on the balance. If I can just stay with it for a month or so I can start calibration of the balance system. The nearest forecast is to start testing by end of the year. I just hope the rig is good enough to be able to repeat data consistently.

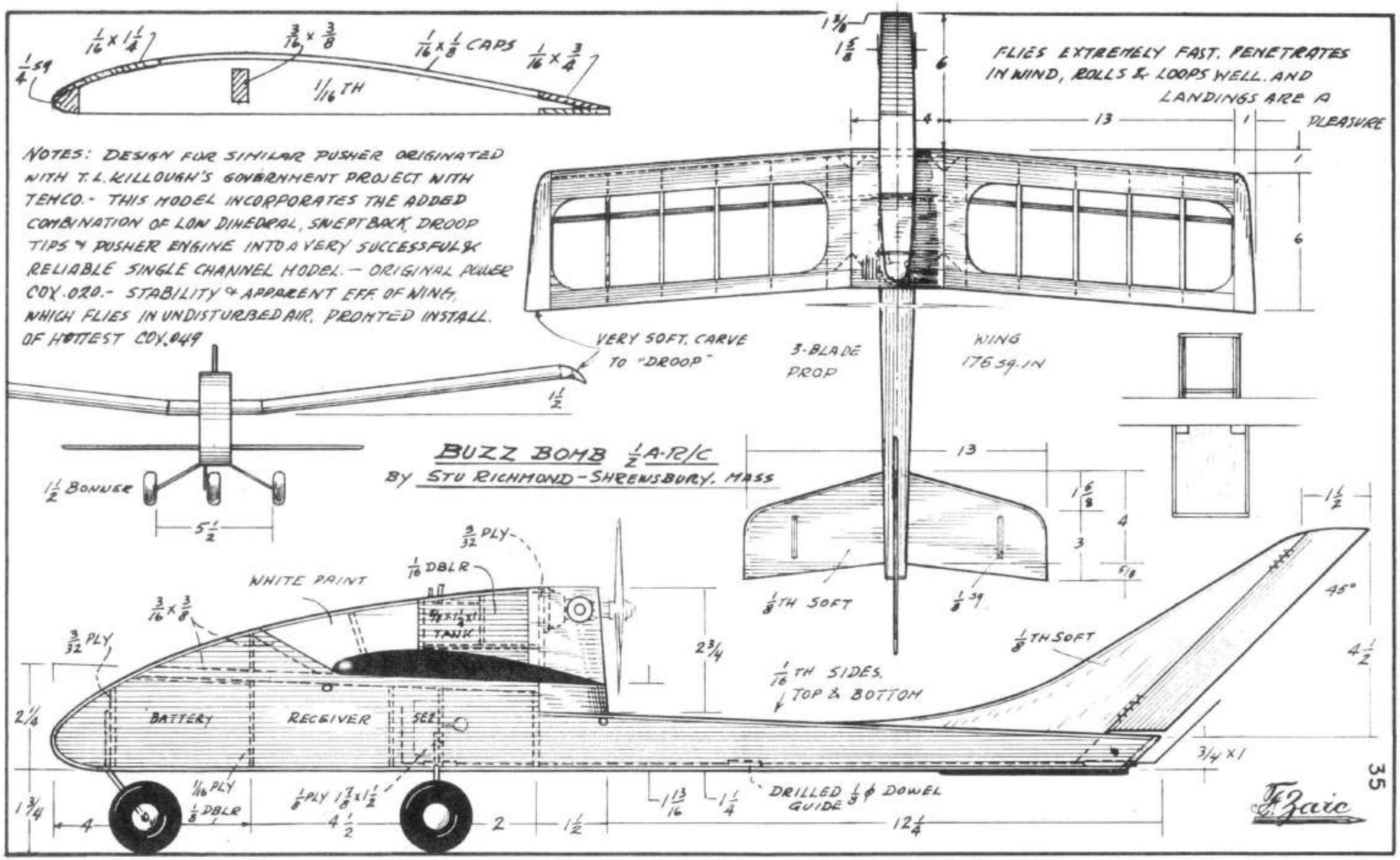


STA	0	2.50	5.00	10	20	30	40	50	60	70	80	90	100
UPR	.90	3.43	5.09	7.27	9.81	10.90	10.90	10.50	9.40	8.00	6.00	3.50	.30
LWR	—	.45	.90	1.45	2.36	2.70	3.09	3.27	3.60	3.27	2.70	1.45	0

WAKEFIELD. Total Surface Area (Projected): 17 to 19 sq. dm. (263.5 to 294.5 sq. in.)—Min. Total Wt.: 230 gms. (8.113 ozs.) Max. Motor Wt.: 50 gm. (1.76 ozs.)

NORDIC A-2. Total Surface Area (Projected): 32 to 34 sq. dm. (495.9 to 526.9 sq. in.) Min. Total Wt. 410 grams (14.46 ozs.)

FAI POWER. Total Min. Wt. in grams: 300 x cm. of engine. (173.4 ozs. per cu. in.) Max. Displace. 2.5 cm. (0.1525 cu. in.) Max. Engine Run: 10 sec.—Min. Surf. Load: 20 gm. per sq. dm. of total area. (6.55 ozs. per sq. ft.)


BUZZ BOMB 1/2 A-R/C
BY STU RICHMOND - SHREWSBURY, MASS
NOTES: DESIGN FOR SIMILAR PUSHER ORIGINATED WITH T. L. KILLOUGH'S GOVERNMENT PROJECT WITH TEMCO.- THIS MODEL INCORPORATES THE ADDED COMBINATION OF LOW DIHEDRAL, SWEPT BACK, DROOP TIPS & PUSHER ENGINE INTO A VERY SUCCESSFUL & RELIABLE SINGLE CHANNEL MODEL.- ORIGINAL POWER COX .020.- STABILITY & APPARENT EFF. OF WING, WHICH FLIES IN UNDISTURBED AIR, PROMTED INSTALL. OF HOTTEST COX .049
FLIES EXTREMELY FAST. PENETRATES IN WIND, ROLLS & LOOPS WELL. AND LANDINGS ARE A PLEASURE
1/16 x 1/4
3/16 x 3/8
1/16 x 1/8 CAPS
1/16 x 3/4
1/4 SQ
1/16 TH
VERY SOFT. CARVE TO "DROOP"
3-BLADE PROP
WING 176 SQ. IN
1 1/2 BONNER
5 1/2
WHITE PAINT
1/16 DBLR
3/32 PLY
3/16 x 3/8
3/32 PLY
5/8 x 1 1/2 x 1 TANK
BATTERY
RECEIVER
SEL
1/16 PLY
1/8 DBLR
1/8 PLY 1 7/8 x 1 1/2
1/8 TH SOFT
1/8 SQ
1/16 TH SIDES, TOP & BOTTOM
DRILLED 1/8 ϕ DOWEL GUIDE
45°
3/4 x 1
F. Zaic

ELECTRIC POWER R/C INDOOR FLYING

Fred Militky Germany

After I made my first electric powered and R/C outdoor flight late in 1963, I decided to do likewise with an indoor model. The problem was how to keep the model light so that its flight will be slow. The model itself did not present weight control as I had enough experience building indoor models, but it was another matter to find light R/C and power gear. — Luckily, power batteries could be had very light in the "one-flight" type.

To power the model I decided to use Micro T03 (25 gr.) because it was more reliable than the lighter Micro T05 (15 gr.) — Mr. Bentert also made for me a very light, 7 g (.095 oz.), receiver. See plans for weight of other parts. Grunding Variphon 2 channel transmitter was used.

The initial R/C glide tests were made in a gym too small for powered flights. With no local indoor sites available for powered flights, I thought of using the salt mines near Heilbron. Permission was granted to use them for experimental flights.

On March 21, 1964, Mr. and Mrs. Heck, Mr. Voigt (mine inspector), my wife and I descended 180 m (660 ft.) down into a round and dome roof hall about 25 m (80 ft.) high and 25 m round. One could see different salt layers along the walls. One felt a peculiar sensation in this dry air atmosphere.

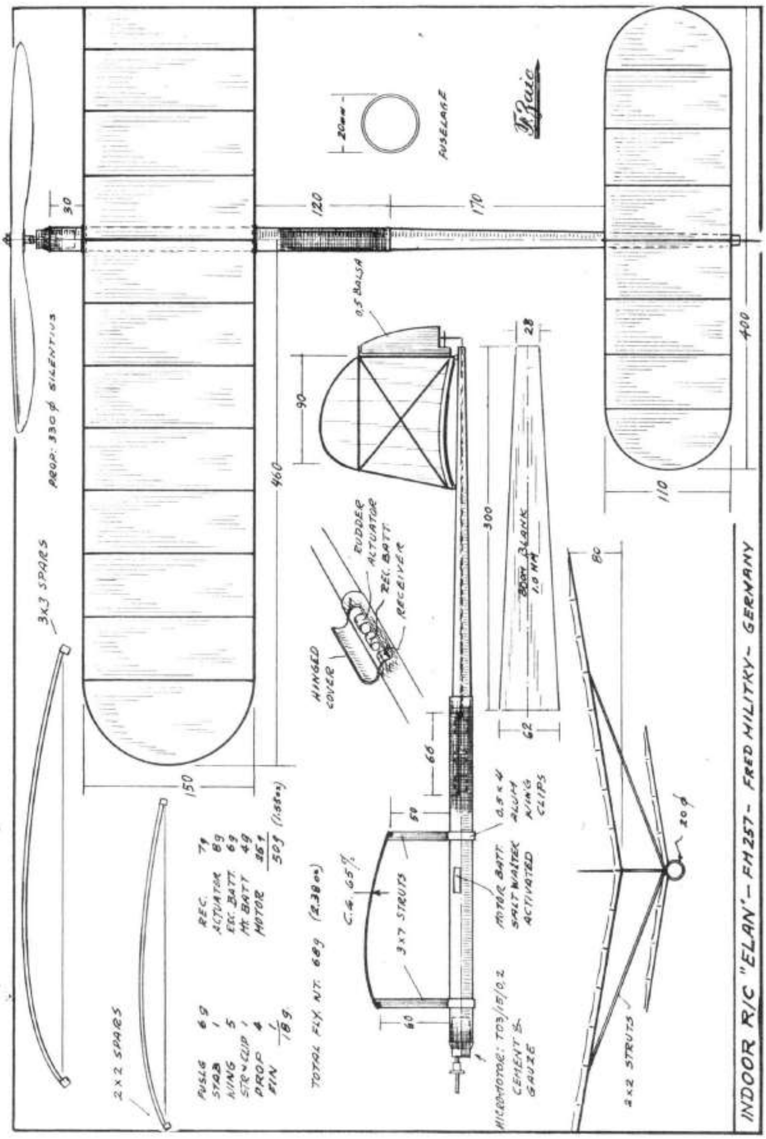
Since the underground hall tapered rather sharply towards the top, I started with rather low power by activating the 2.2 v. batteries with pure water. Evidently, the voltage produced was not enough for a climb.

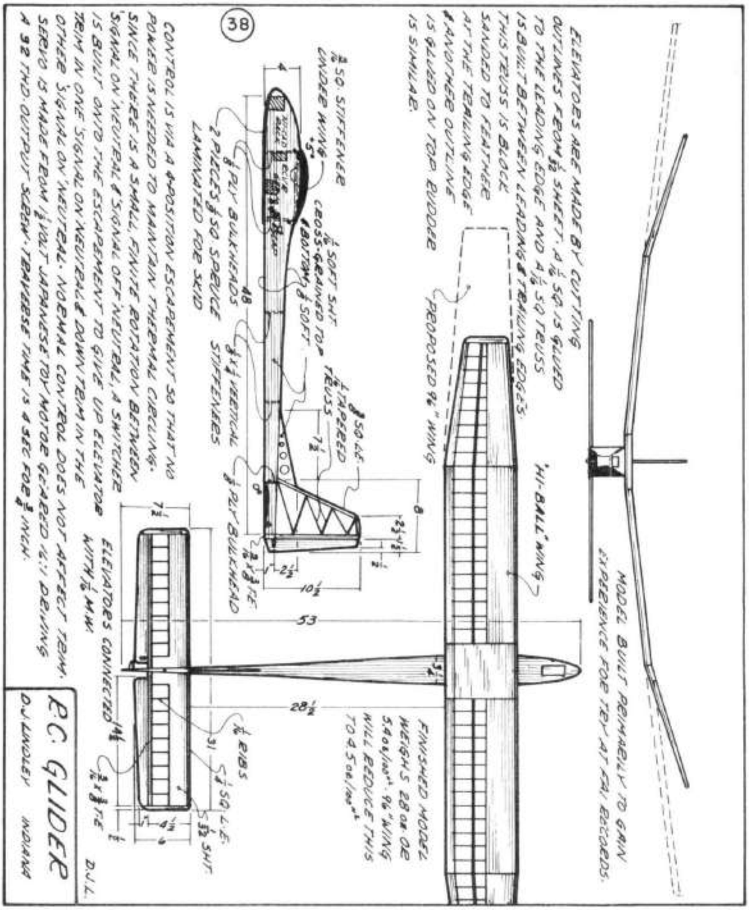
On the second try, the batteries were activated with 10% salt solution water. While the model climbed easily to 8 m (26 ft.) it was constantly corrected or maneuvered with R/C. Without pulsing, the rudder is set for a right turn. By pulsing left rudder, the model is caused to circle to the left. Since the model flies rather slowly, it is quite easy to guide it accurately with a series of pulses. The R/C unit worked perfectly, and the climb with salt activated batteries was just right. The flight lasted 1 min 45 sec. This was my first successful electro-powered R/C Indoor flight.

The third flight, with similar batteries, was duplicate of the second with almost identical duration.

On the fourth flight I tried a larger two-cell battery. Although it was also rated at 2.2 V it had enough amperage to keep the motor running for a 10-15 min. flight. But it seems that this battery must have had a higher voltage than batteries on other flights as the initial torque of the motor caused the wing structure to flex or warp and force the model into a left dive. The wing and struts remained intact, but the fuselage broke. Thus ending the experiment.

It can be seen that the major problem in Indoor R/C flying is the control of altitude of the model. In large halls this is no problem as the model can be spiraled down, and then allowed to climb again. But for low roof or girders, the model may not have enough room to safely recover from spirals. It would seem that the best solution for such cases would be to have a two channel control. The extra control to switch the motor on and off as needed. — When the model is too high for safety, switch off the motor and let the model glide to lower altitude, and then switch the motor on for another climbing flight. This extra control is especially useful when the voltage of the batteries changes with activating solutions and temperatures.





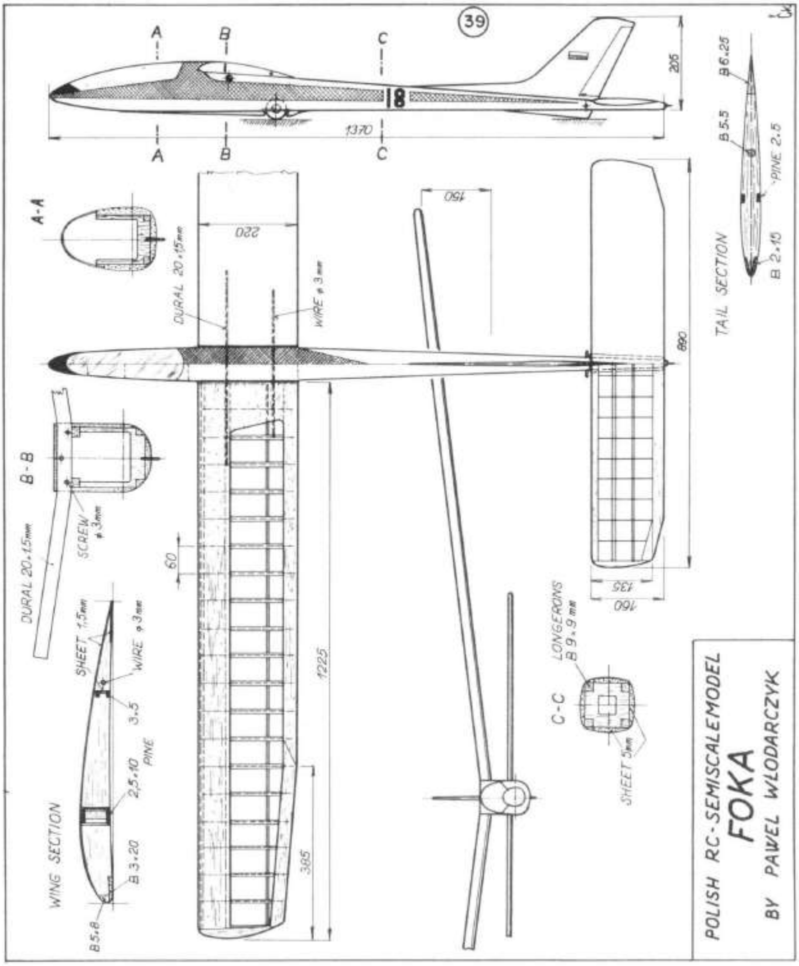
SOARING WITH R/C MODELS

Bill Roseberry — Phoenix, Ariz.

When you read this, please remember I am a glider pilot at heart. Watching a Hand Launched or Nordic glider in flight as they respond to the slightest change in air currents seems to me to be the epitomy of flight. Let's compare this with the gross-ungainly-overweight typical multi-job used in *non-contest* radio control. This beast flies by brute force (Power) and rapid manipulation of the control surfaces to keep the aircraft on a desired heading.

It is possible to do scale like flying by trimming your R/C model for maximum performance at low engine speed. For example:

Take a TARUS which weighs 6.5 lbs., powered by a Veco 45, proportional or reed. Strike a datum line down the fuselage. Zero engine, wing and tail. Remove decalage and downthrust. Zero ailerons, rudder and elevator and elevator trim. Now, start test flying. The purpose of the test flying is to move the C.G. location until the

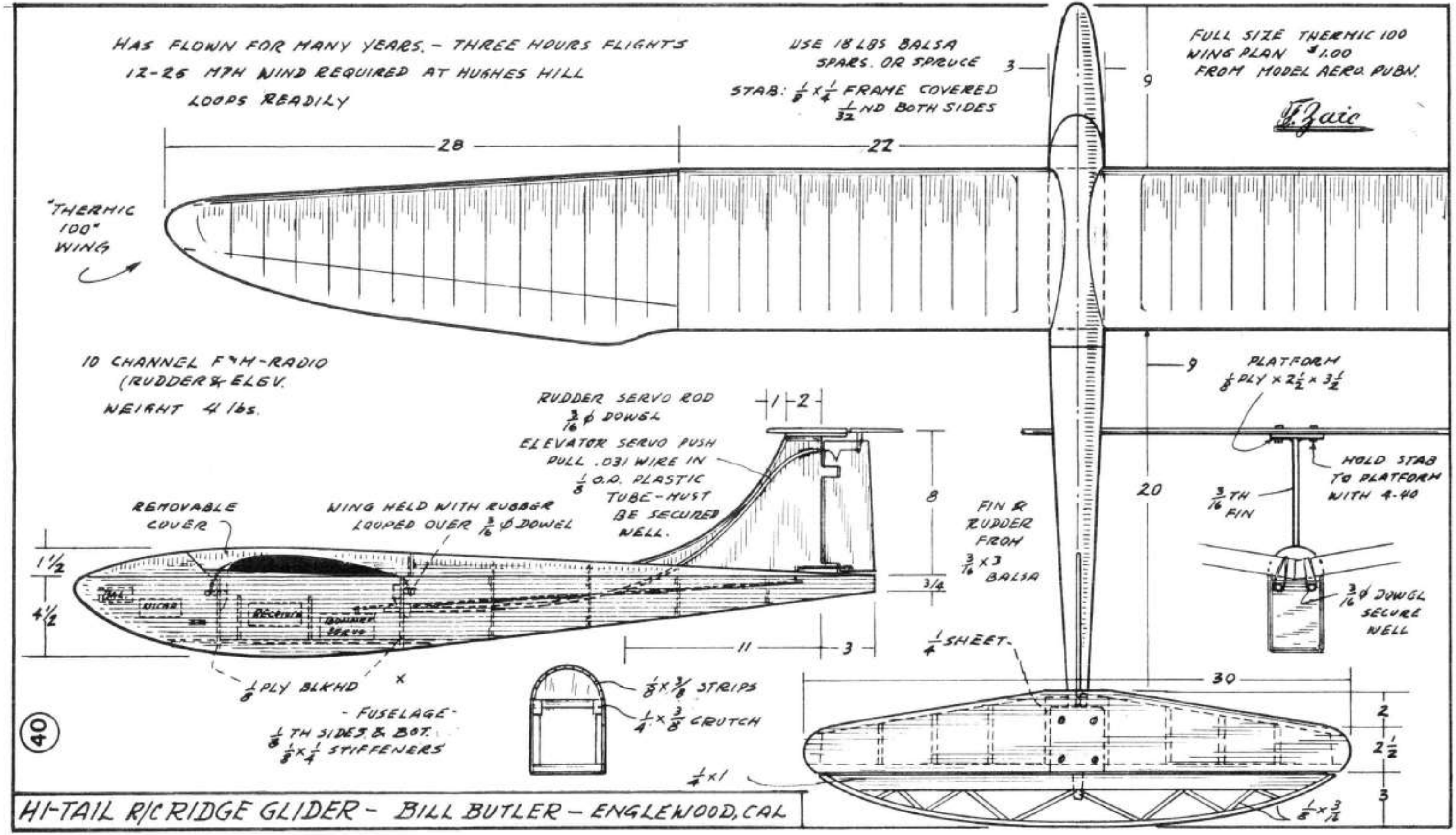


model will fly level at low speed with "HANDS OFF". The model is now trimmed, statically and aerodynamically, and has inherent stability.

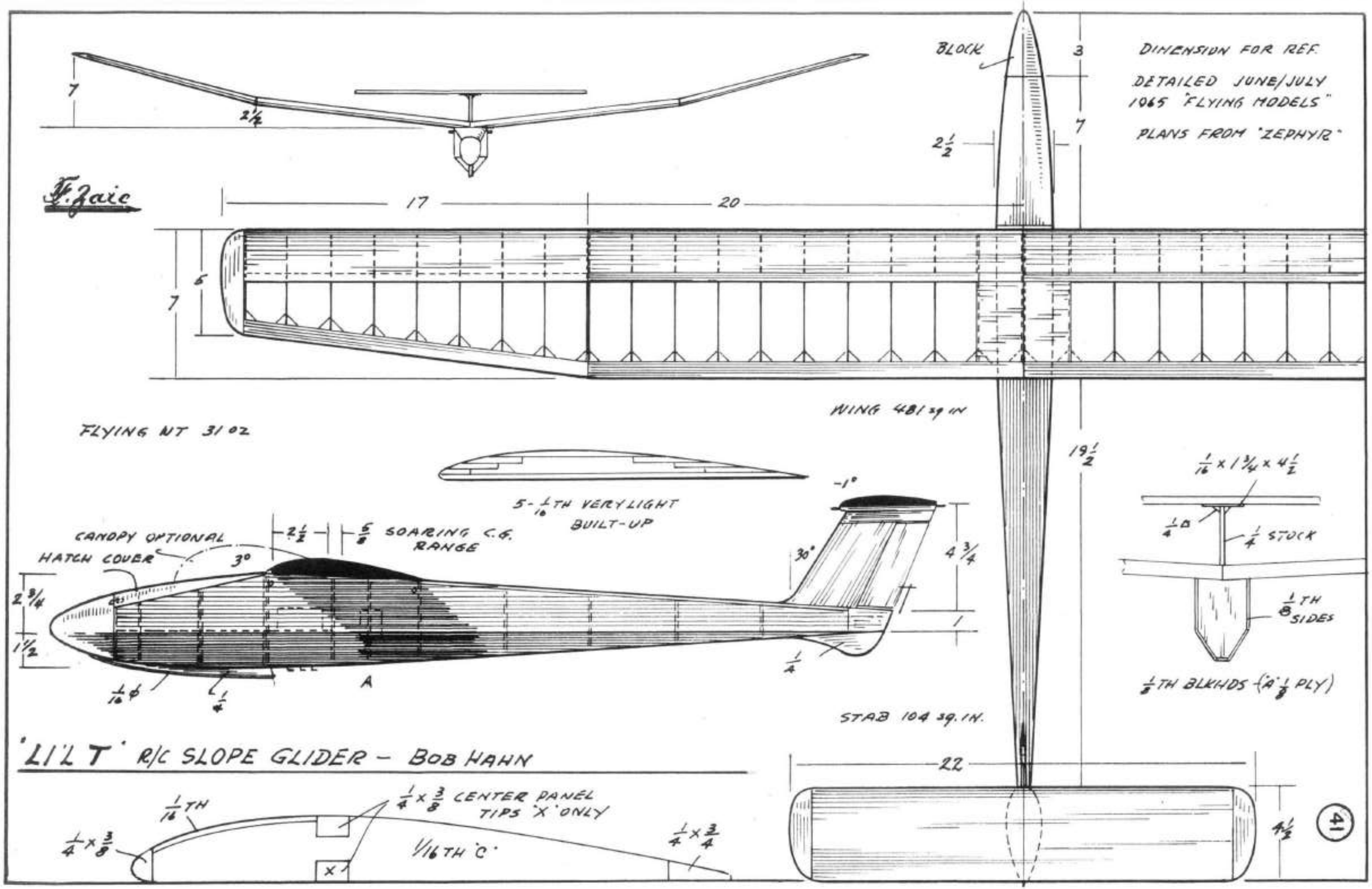
Now climb upstairs, using elevator & aileron for a near free flight climb. At 200-300 feet altitude, reduce throttle to idle or near idle and fly the aircraft through maneuvers. Notice that you have to FLY, not power through loops and rolls. The aircraft is not hauled around by the engine.

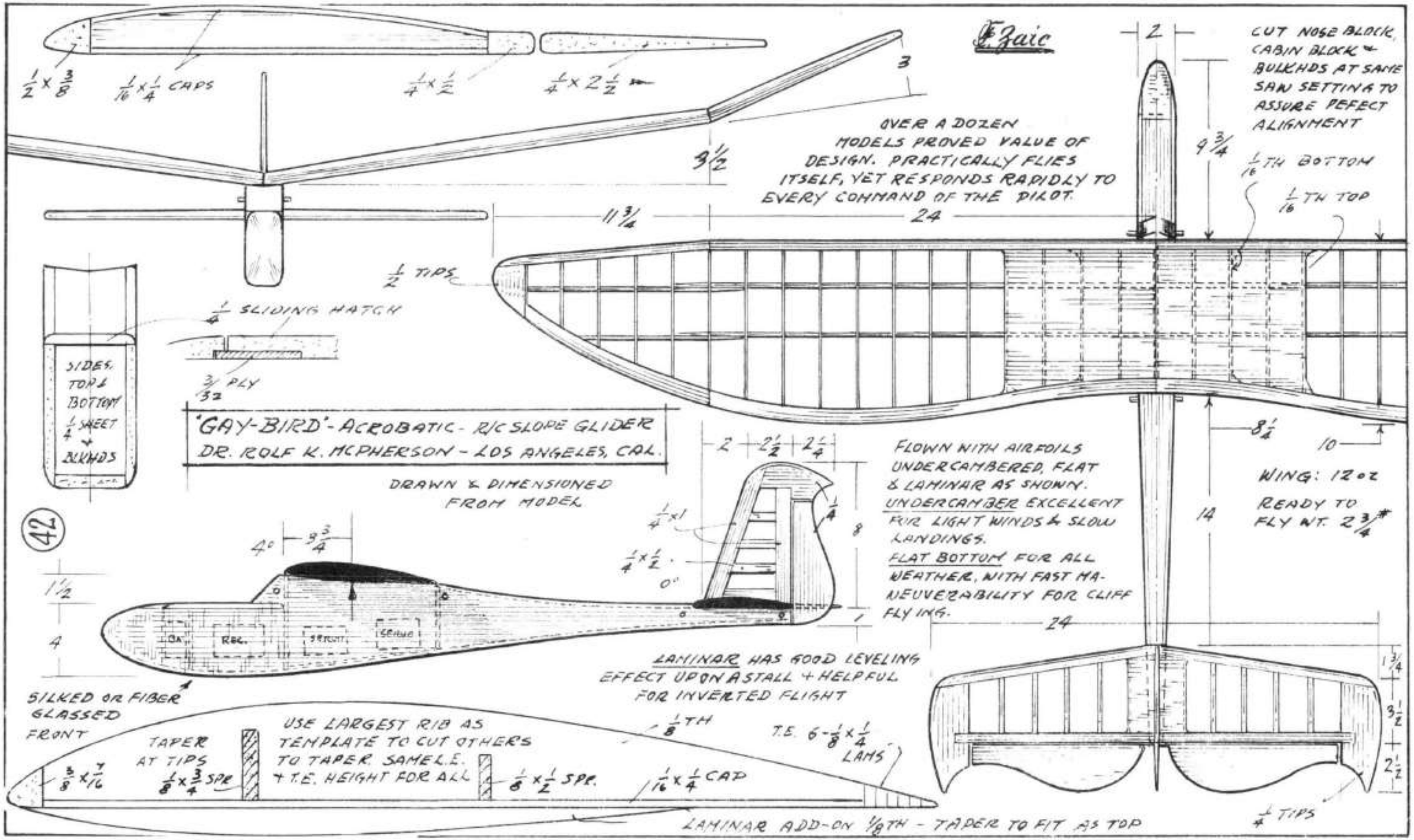
Next, gain altitude and cut the engine off. Trim for a FLAT glide using turn to prevent stall and again go through maneuvers. This dead stick pattern will amaze the modeler. The glide is fast but the model will float and float making the pattern approach and spot very difficult to perform.

After a few flights like this, you will notice your aircraft bumping thermals and the considerable increase in dead stick time. This is another aspect of the sport of model flying and may lead the way out of the woods and return to scale type of flight.

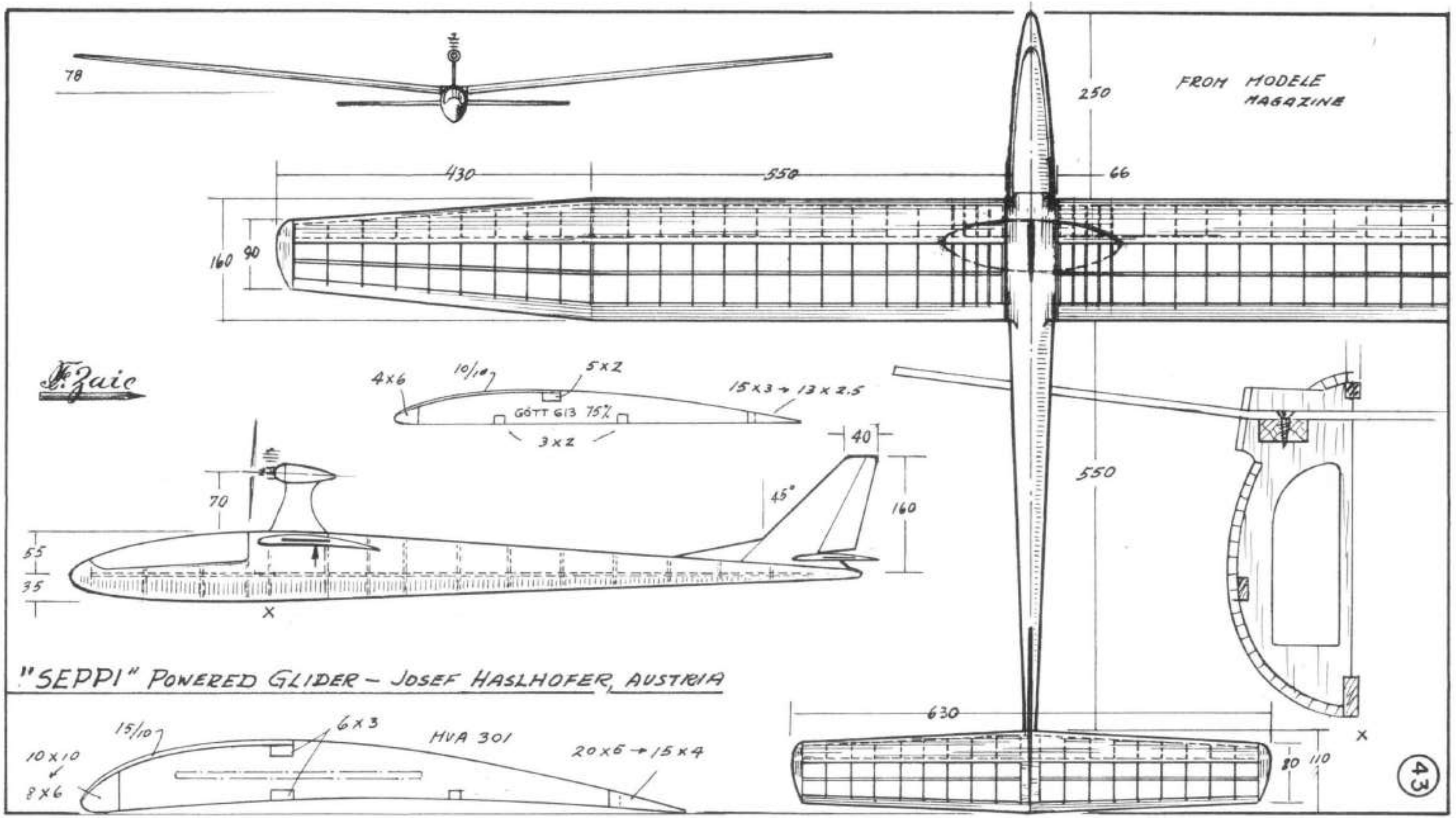


HAS FLOWN FOR MANY YEARS. - THREE HOURS FLIGHTS
12-26 MPH WIND REQUIRED AT HUGHES HILL
LOOPS READILY
USE 18 LBS BALSA SPARS. OR SPRUCE
STAB: 1/8 x 1/4 FRAME COVERED 1/32 ND BOTH SIDES
FULL SIZE THERMIC 100 WING PLAN $1.00 FROM MODEL AERO PUBN.
F. Zaic
"THERMIC 100" WING
28
22
3
9
10 CHANNEL F+M-RADIO (RUDDER & ELEV.
WEIGHT 4 lbs.
RUDDER SERVO ROD 3/16 ∅ DOWEL
ELEVATOR SERVO PUSH PULL .031 WIRE IN 1/8 O.D. PLASTIC TUBE - MUST BE SECURED WELL.
PLATFORM 1/8 PLY x 2 1/2 x 3 1/2
HOLD STAB TO PLATFORM WITH 4-40
3/16 TH FIN
3/16 ∅ DOWEL SECURE WELL
REMOVABLE COVER
WING HELD WITH RUBBER LOOPED OVER 3/16 ∅ DOWEL
FIN & RUDDER FROM 3/16 x 3 BALSA
1 1/2
4 1/2
1
2
8
3/4
20
11
3
1/8 PLY BLKHD
- FUSELAGE -
1/8 TH SIDES & BOT.
1/8 x 1/4 STIFFENERS
1/8 x 3/8 STRIPS
1/4 x 3/8 CRUTCH
1/4 SHEET
1/4 x 1
30
2
2 1/2
3
1/8 x 3/16
40
HI-TAIL R/C RIDGE GLIDER - BILL BUTLER - ENGLEWOOD, CAL

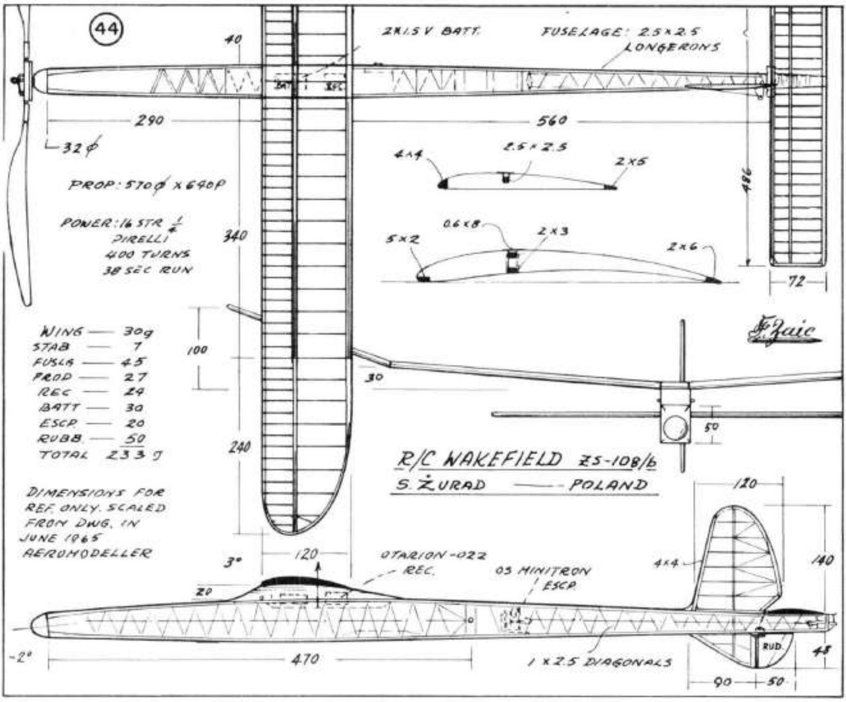

DIMENSION FOR REF.
DETAILED JUNE/JULY 1965 "FLYING MODELS"
PLANS FROM "ZEPHYR"
BLOCK
F. Zaic
17
20
WING 481 sq in
FLYING WT 31 OZ
5-1/16TH VERYLIGHT BUILT-UP
CANOPY OPTIONAL
HATCH COVER
2 1/2
5/8 SOARING C.G. RANGE
30°
-1°
4 3/4
19 1/2
1/16 x 1 3/4 x 4 1/2
1/4 STOCK
1/8 TH SIDES
1/8 TH BLKHDS (A 1/8 PLY)
STAB 104 sq. IN.
22
'LI'L T' R/C SLOPE GLIDER - BOB HAHN
1/16 TH
1/4 x 3/8 CENTER PANEL TIPS 'X' ONLY
1/16TH 'C'
1/4 x 3/8
1/4 x 3/4
41

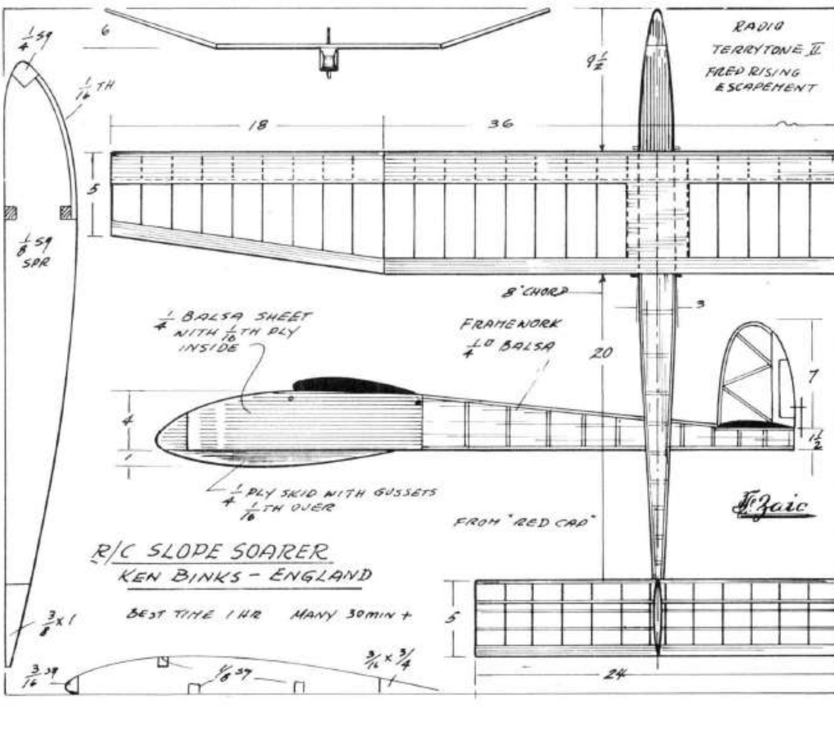


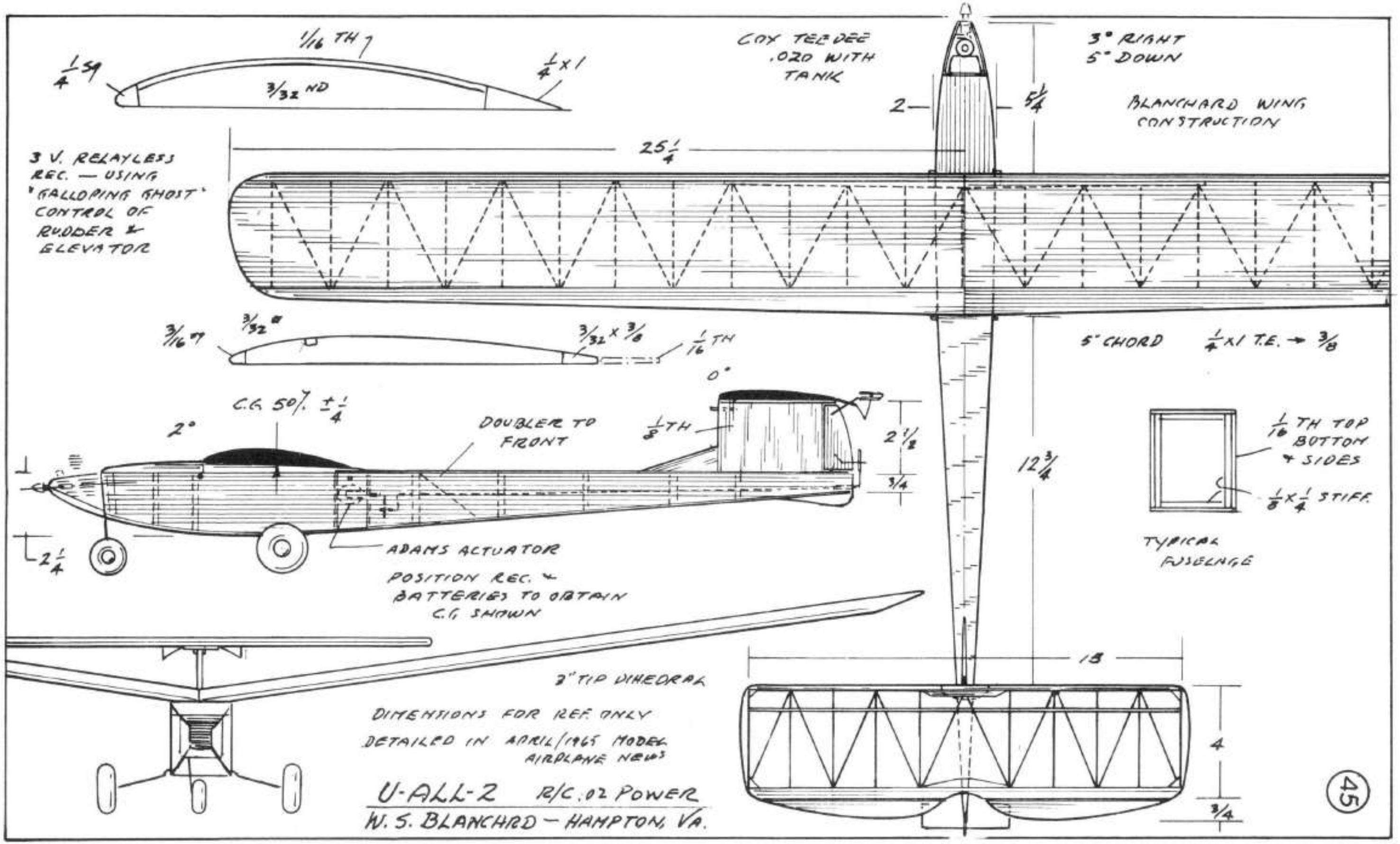
F. Zaic
"GAY-BIRD" - ACROBATIC - R/C SLOPE GLIDER
DR. ROLF K. MCPHERSON - LOS ANGELES, CAL.
DRAWN & DIMENSIONED FROM MODEL
42
OVER A DOZEN MODELS PROVED VALUE OF DESIGN. PRACTICALLY FLIES ITSELF, YET RESPONDS RAPIDLY TO EVERY COMMAND OF THE PILOT.
CUT NOSE BLOCK, CABIN BLOCK & BULKHDS AT SAME SAW SETTING TO ASSURE PEFECT ALIGNMENT
1/16 TH BOTTOM
1/16 TH TOP
1/2 x 3/8
1/16 x 1/4 CAPS
1/4 x 1/2
1/4 x 2 1/2
3
3 1/2
11 3/4
24
9 3/4
2
1/2 TIPS
1/4 SLIDING HATCH
3/32 PLY
SIDES, TOP & BOTTOM 1/4 SHEET & BLKHDS
FLOWN WITH AIRFOILS UNDERCAMBERED, FLAT & LAMINAR AS SHOWN.
UNDERCAMBER EXCELLENT FOR LIGHT WINDS & SLOW LANDINGS.
FLAT BOTTOM FOR ALL WEATHER, WITH FAST MANEUVERABILITY FOR CLIFF FLYING.
WING: 12 oz
READY TO FLY WT. 2 3/4 #
8 1/4
10
14
24
1 3/4
3 1/2
2 1/2
1/4 TIPS
2
2 1/2
2 1/4
1/4 x 1
1/4 x 1/2
1/4
8
1
0°
4°
9 3/4
1 1/2
4
BAT.
REC.
WEIGHT
SERVO
SILKED OR FIBER GLASSED FRONT
LAMINAR HAS GOOD LEVELING EFFECT UPON A STALL + HELPFUL FOR INVERTED FLIGHT
USE LARGEST RIB AS TEMPLATE TO CUT OTHERS TO TAPER. SAME L.E. + T.E. HEIGHT FOR ALL
TAPER AT TIPS
3/8 x 7/16
1/8 x 3/4 SPR
1/8 x 1/2 SPR.
1/16 x 1/4 CAP
1/8 TH
T.E. 6 - 1/8 x 1/4 LAMS
LAMINAR ADD-ON 1/8 TH - TAPER TO FIT AS TOP

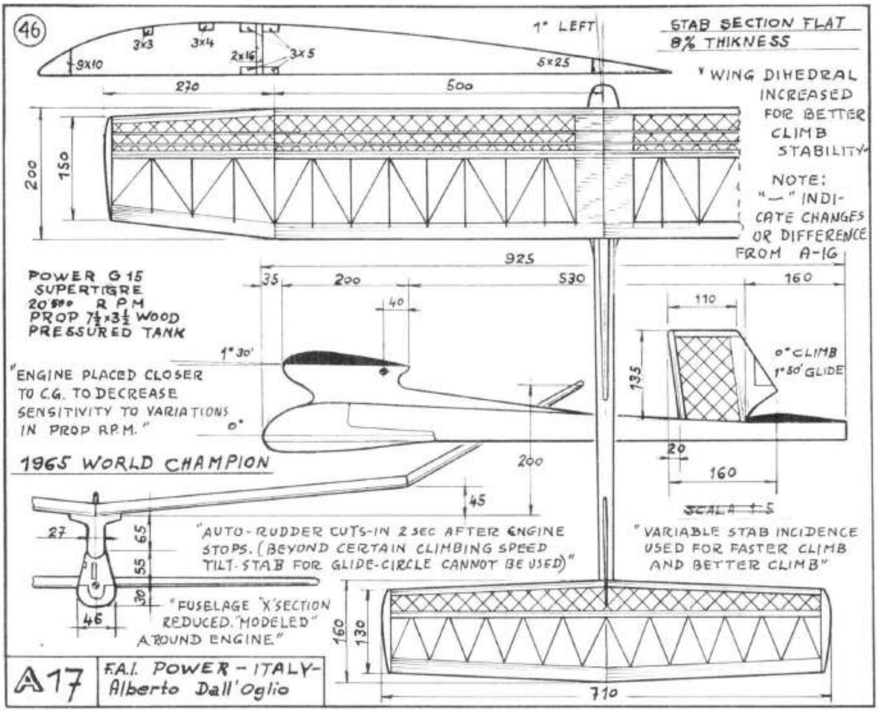


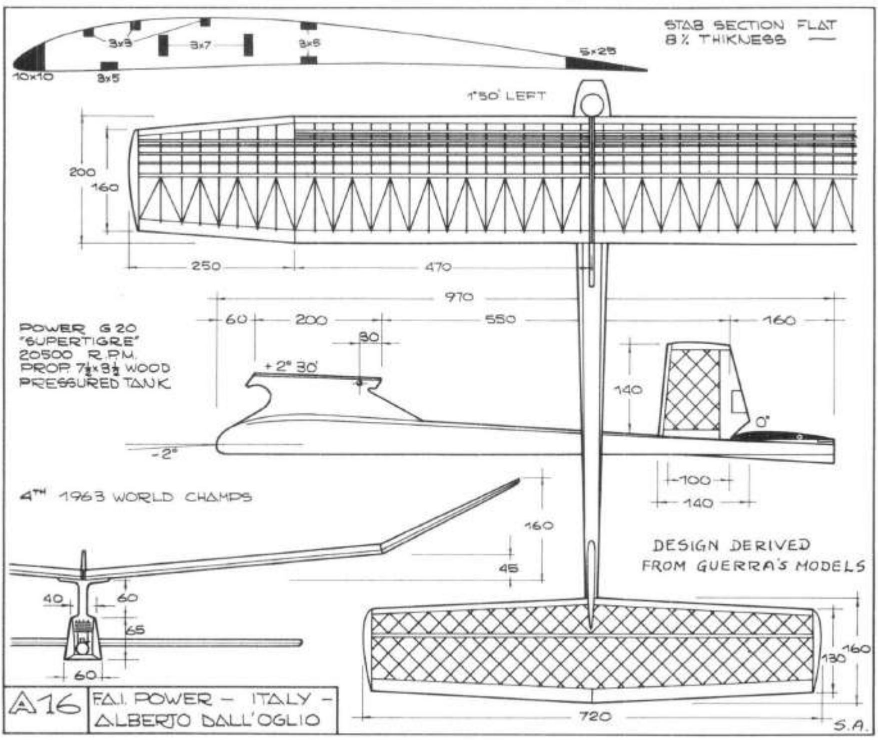
"SEPPI" POWERED GLIDER – JOSEF HASLHOFER, AUSTRIA

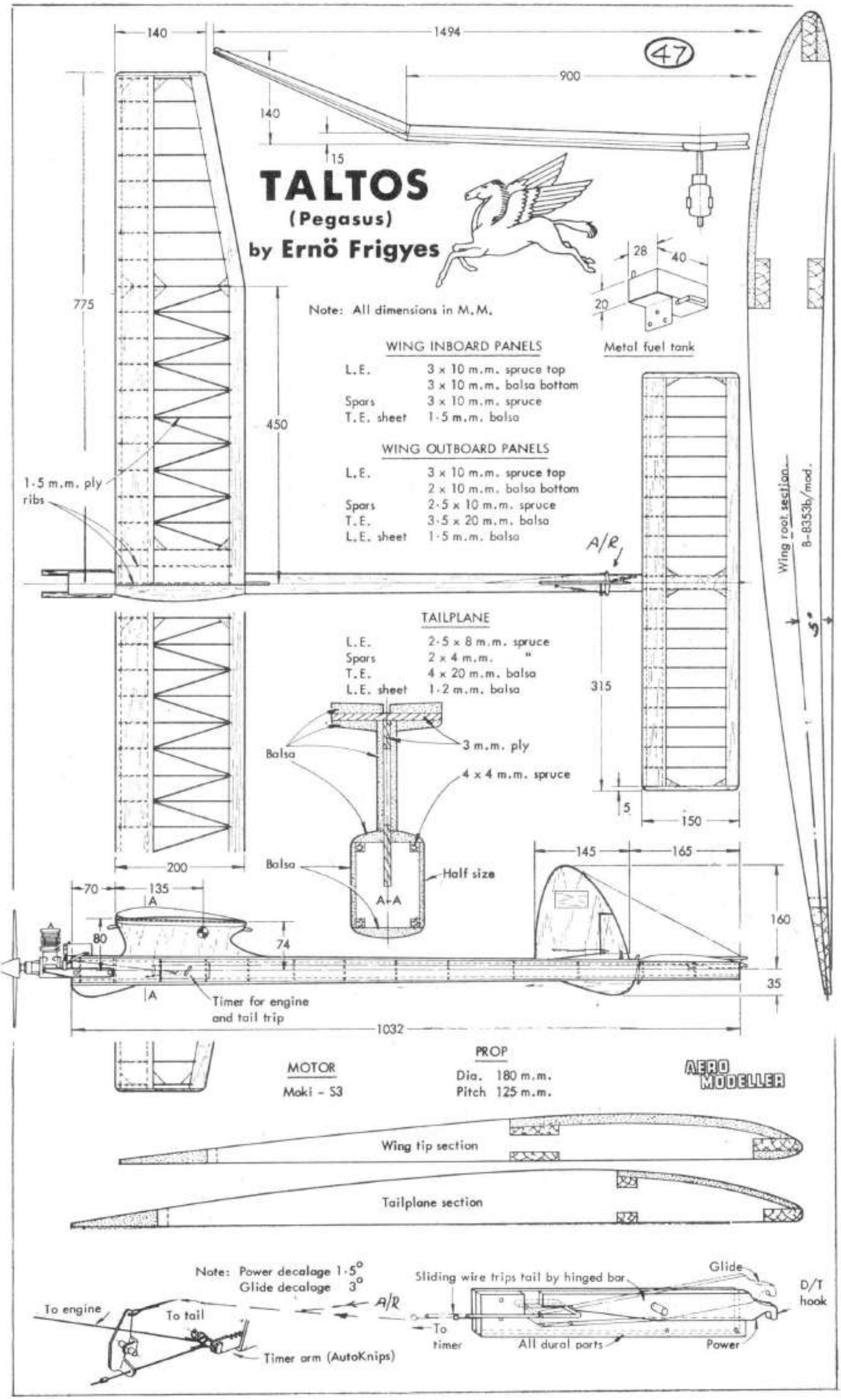

44
2×1.5 V BATT.
FUSELAGE: 2.5×2.5 LONGERONS
40
290
560
32 ϕ
PROP: 570ϕ × 690P
POWER: 16 STR 1/4 PIRELLI
400 TURNS
38 SEC RUN
4×4
2.5×2.5
2×5
0.6×8
2×3
5×2
2×6
340
436
72
WING — 30g
STAB — 7
FUSLG — 45
PROP — 27
REC — 24
BATT — 30
ESCP — 20
RUBB. — 50
TOTAL 233 g
100
30
50
240
R/C WAKEFIELD ZS-108/6
S. ŻURAD — POLAND
DIMENSIONS FOR REF. ONLY. SCALED FROM DWG. IN JUNE 1965 AEROMODELLER
120
140
3°
OTARION-022 REC.
05 MINITRON ESCP.
4×4
20
-2°
470
1 × 2.5 DIAGONALS
RUD.
48
90
50
F. Zaic


1/4 SQ
6
RADIO TERRYTONE II
FRED RISING ESCAPEMENT
9 1/2
1/16 TH
18
36
5
1/8 SQ SPR
8" CHORD
3
1/4 BALSA SHEET WITH 1/16 TH PLY INSIDE
FRAMEWORK 1/4 □ BALSA
20
7
4
1
1 1/2
1/4 PLY SKID WITH GUSSETS 1/16 TH OVER
FROM "RED CAP"
F. Zaic
R/C SLOPE SOARER
KEN BINKS - ENGLAND
BEST TIME 1 HR MANY 30 MIN +
3/8 × 1
5
3/16 SQ
1/8 SQ
3/16 × 3/4
24

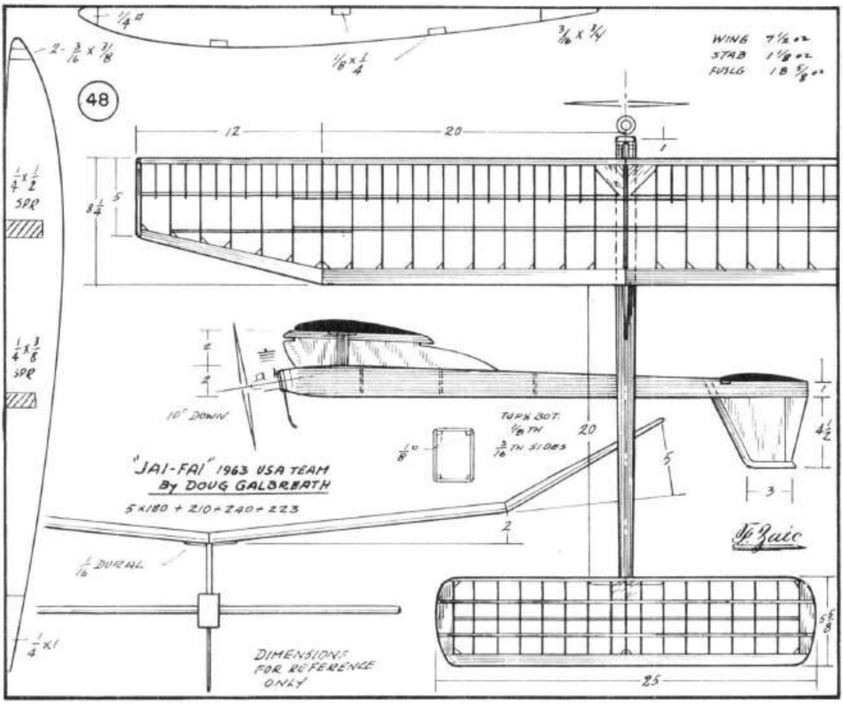

1/16 TH
1/4 SQ
3/32 ND
1/4 x 1
COX TEE DEE .020 WITH TANK
3° RIGHT
5° DOWN
2
5 1/4
BLANCHARD WING CONSTRUCTION
25 1/4
3 V. RELAYLESS REC. — USING "GALLOPING GHOST" CONTROL OF RUDDER & ELEVATOR
3/16 SQ
3/32 SQ
3/32 x 3/8
1/16 TH
5" CHORD
1/4 x 1 T.E. → 3/8
0°
C.G. 50% ± 1/4
2°
DOUBLER TO FRONT
1/8 TH
2 1/2
3/4
12 3/4
1/16 TH TOP BOTTOM & SIDES
1/8 x 1/4 STIFF.
TYPICAL FUSELAGE
2 1/4
ADAMS ACTUATOR
POSITION REC. & BATTERIES TO OBTAIN C.G. SHOWN
3" TIP DIHEDRAL
13
4
3/4
DIMENSIONS FOR REF. ONLY
DETAILED IN APRIL/1965 MODEL AIRPLANE NEWS
U-ALL-2 R/C .02 POWER
W. S. BLANCHRD — HAMPTON, VA.

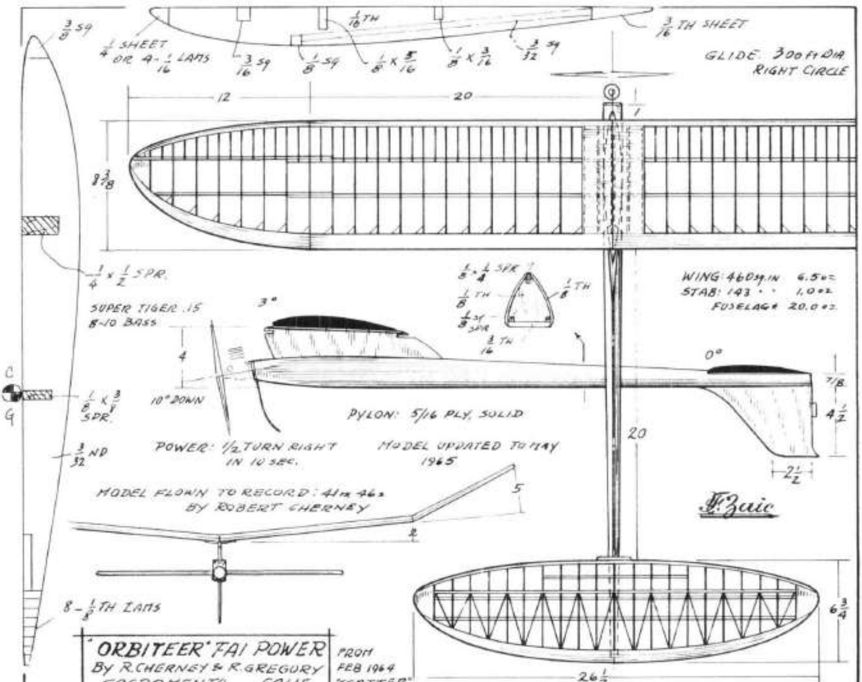

46
3x3
3x4
2x16
3x5
9x10
5x25
1° LEFT
STAB SECTION FLAT
8% THIKNESS
"WING DIHEDRAL INCREASED FOR BETTER CLIMB STABILITY"
NOTE: "—" INDICATE CHANGES OR DIFFERENCE FROM A-16
270
500
200
150
925
35
200
530
160
40
110
135
POWER G 15
SUPERTIGRE
20'500 R P M
PROP 7½x3½ WOOD
PRESSURED TANK
1° 30'
0° CLIMB
1° 30' GLIDE
"ENGINE PLACED CLOSER TO C.G. TO DECREASE SENSITIVITY TO VARIATIONS IN PROP RP.M."
0°
1965 WORLD CHAMPION
20
160
200
45
SCALA 1:5
27
65
55
30
46
"AUTO-RUDDER CUTS-IN 2 SEC AFTER ENGINE STOPS. (BEYOND CERTAIN CLIMBING SPEED TILT-STAB FOR GLIDE-CIRCLE CANNOT BE USED)"
"VARIABLE STAB INCIDENCE USED FOR FASTER CLIMB AND BETTER CLIMB"
"FUSELAGE 'X' SECTION REDUCED. 'MODELED' AROUND ENGINE."
160
130
710
A17
F.A.I. POWER - ITALY-
Alberto Dall'Oglio

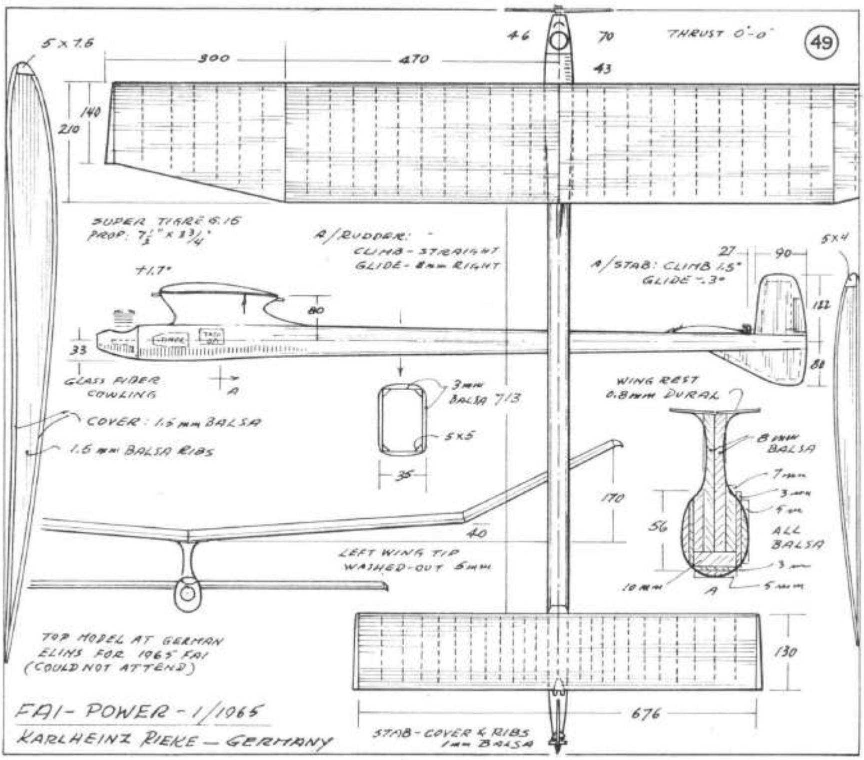

3x9
3x7
3x5
10x10
3x5
5x25
STAB SECTION FLAT
8% THIKNESS —
1°50' LEFT
200
160
250
470
970
60
200
550
160
30
POWER G 20
"SUPERTIGRE"
20500 R.P.M.
PROP 7½x3½ WOOD
PRESSURED TANK
+2° 30'
140
0°
-2°
100
140
4TH 1963 WORLD CHAMPS
160
45
DESIGN DERIVED FROM GUERRA'S MODELS
40
60
65
60
130
160
720
A16
F.A.I. POWER – ITALY –
ALBERTO DALL'OGLIO
S.A.



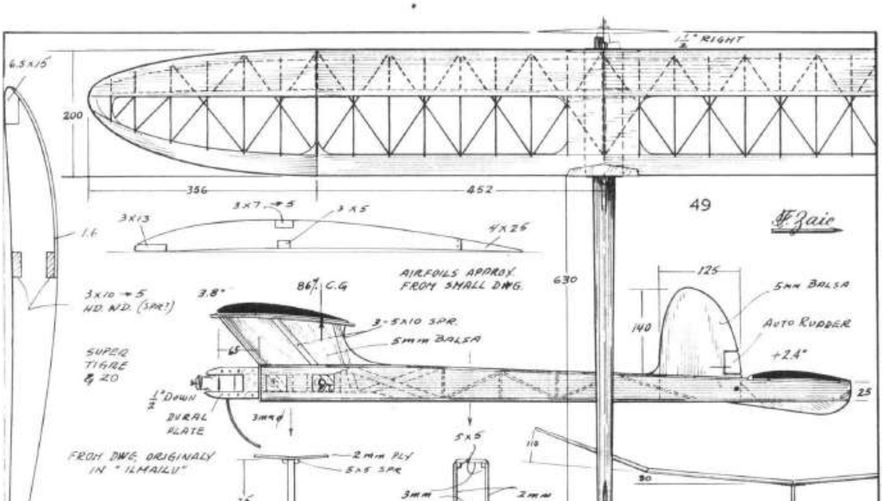
47
TALTOS
(Pegasus)
by Ernö Frigyes
Note: All dimensions in M.M.
WING INBOARD PANELS
L.E. 3 x 10 m.m. spruce top
3 x 10 m.m. balsa bottom
Spars 3 x 10 m.m. spruce
T.E. sheet 1·5 m.m. balsa
WING OUTBOARD PANELS
L.E. 3 x 10 m.m. spruce top
2 x 10 m.m. balsa bottom
Spars 2·5 x 10 m.m. spruce
T.E. 3·5 x 20 m.m. balsa
L.E. sheet 1·5 m.m. balsa
TAILPLANE
L.E. 2·5 x 8 m.m. spruce
Spars 2 x 4 m.m. "
T.E. 4 x 20 m.m. balsa
L.E. sheet 1·2 m.m. balsa
Metal fuel tank
28
40
20
140
1494
900
140
15
775
450
1·5 m.m. ply ribs
A/R
315
5
150
200
Balsa
3 m.m. ply
4 x 4 m.m. spruce
Balsa
Half size
A-A
145
165
160
35
70
135
A
80
74
A
Timer for engine and tail trip
1032
Wing root section
B-8353b/mod.
5°
MOTOR
Moki - S3
PROP
Dia. 180 m.m.
Pitch 125 m.m.
AERO MODELLER
Wing tip section
Tailplane section
Note: Power decalage 1·5°
Glide decalage 3°
To engine
To tail
A/R
Timer arm (AutoKnips)
Sliding wire trips tail by hinged bar
Glide
D/T hook
To timer
All dural parts
Power


48
WING 7 1/2 oz
STAB 1 1/8 oz
FUSLG 18 5/8 oz
"JAI-FAI" 1963 USA TEAM
BY DOUG GALBREATH
5×180 + 210 + 240 + 223
10° DOWN
TOP & BOT. 1/8 TH
3/16 TH SIDES
1/16 DURAL
DIMENSIONS FOR REFERENCE ONLY
1/4 × 1/2 SPR
1/4 × 3/8 SPR
12
20
25
F. Zaic

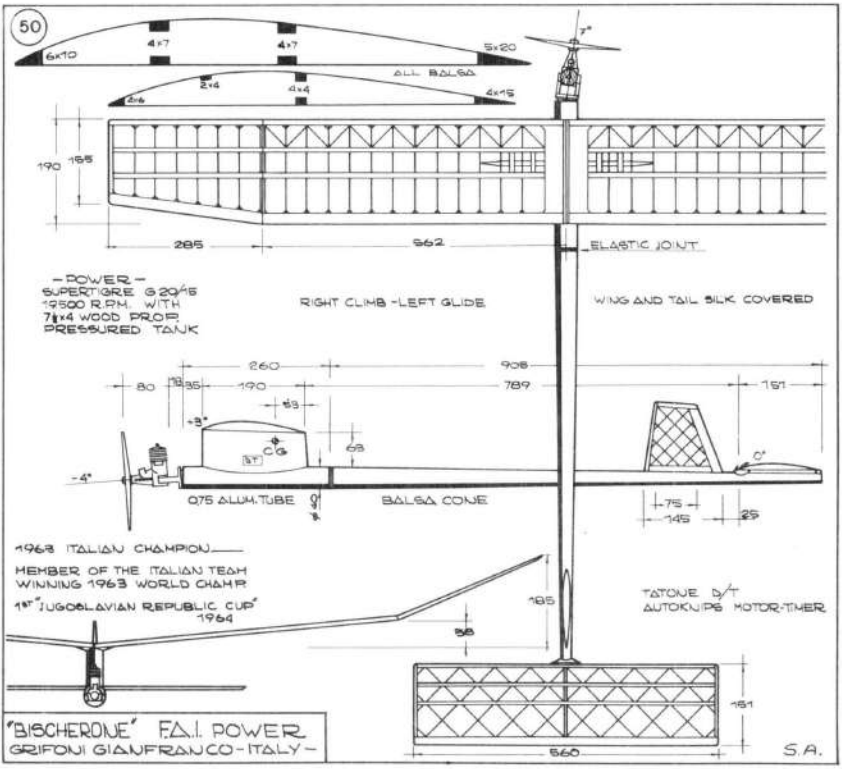

1/4 SHEET OR 4 - 1/16 LAMS
3/16 TH SHEET
GLIDE: 300 ft DIA. RIGHT CIRCLE
WING: 460 sq.in 6.5 oz
STAB: 143 " " 1.0 oz
FUSELAGE 20.0 oz
SUPER TIGER .15
8-10 BASS
10° DOWN
PYLON: 5/16 PLY, SOLID
POWER: 1/2 TURN RIGHT IN 10 SEC.
MODEL UPDATED TO MAY 1965
MODEL FLOWN TO RECORD: 41 m 46 s
BY ROBERT CHERNEY
8 - 1/8 TH LAMS
"ORBITEER" FAI POWER
BY R. CHERNEY & R. GREGORY
SACRAMENTO CALIF
FROM FEB 1964 "SCATTER"
26 1/2
F. Zaic



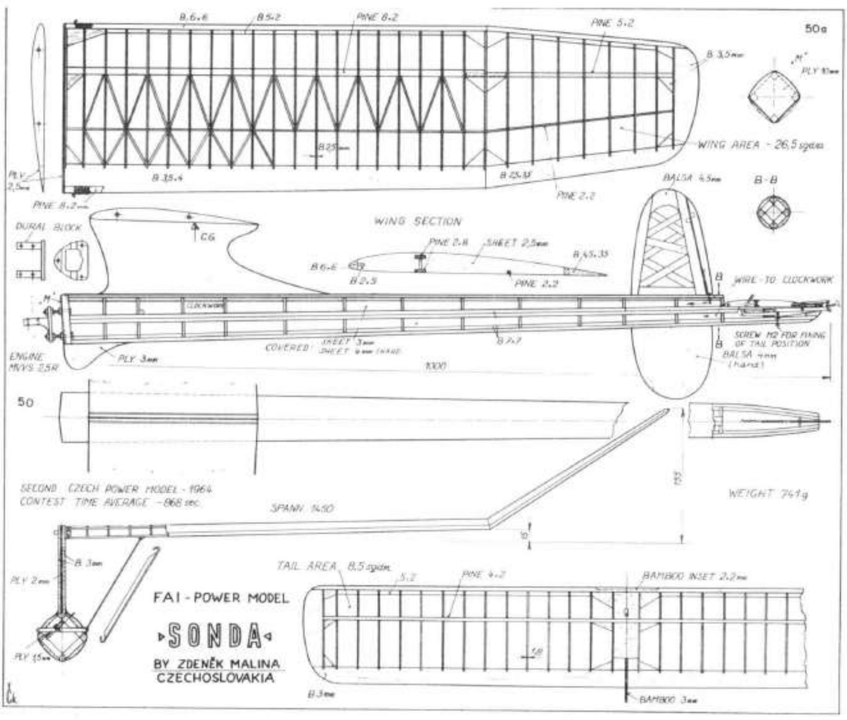
49
THRUST 0°-0°
5 x 7.5
300
470
46
70
43
140
210
SUPER TIGRE G.15
PROP: 7 1/2" x 3 3/4"
A/RUDDER:
CLIMB - STRAIGHT
GLIDE - 8mm RIGHT
A/STAB: CLIMB 1.5°
GLIDE -.3°
27
90
5x4
+1.7°
80
122
33
80
GLASS FIBER COWLING
A
3mm BALSA 7/3
5x5
35
COVER: 1.5 mm BALSA
1.5 mm BALSA RIBS
WING REST 0.8mm DURAL
8mm BALSA
7mm
3mm
5m
ALL BALSA
3mm
5mm
10mm
A
170
56
40
LEFT WING TIP WASHED-OUT 5mm
TOP MODEL AT GERMAN ELIMS FOR 1965 FAI (COULD NOT ATTEND)
130
676
FAI- POWER - 1/1965
KARLHEINZ RIEKE — GERMANY
STAB - COVER & RIBS 1mm BALSA



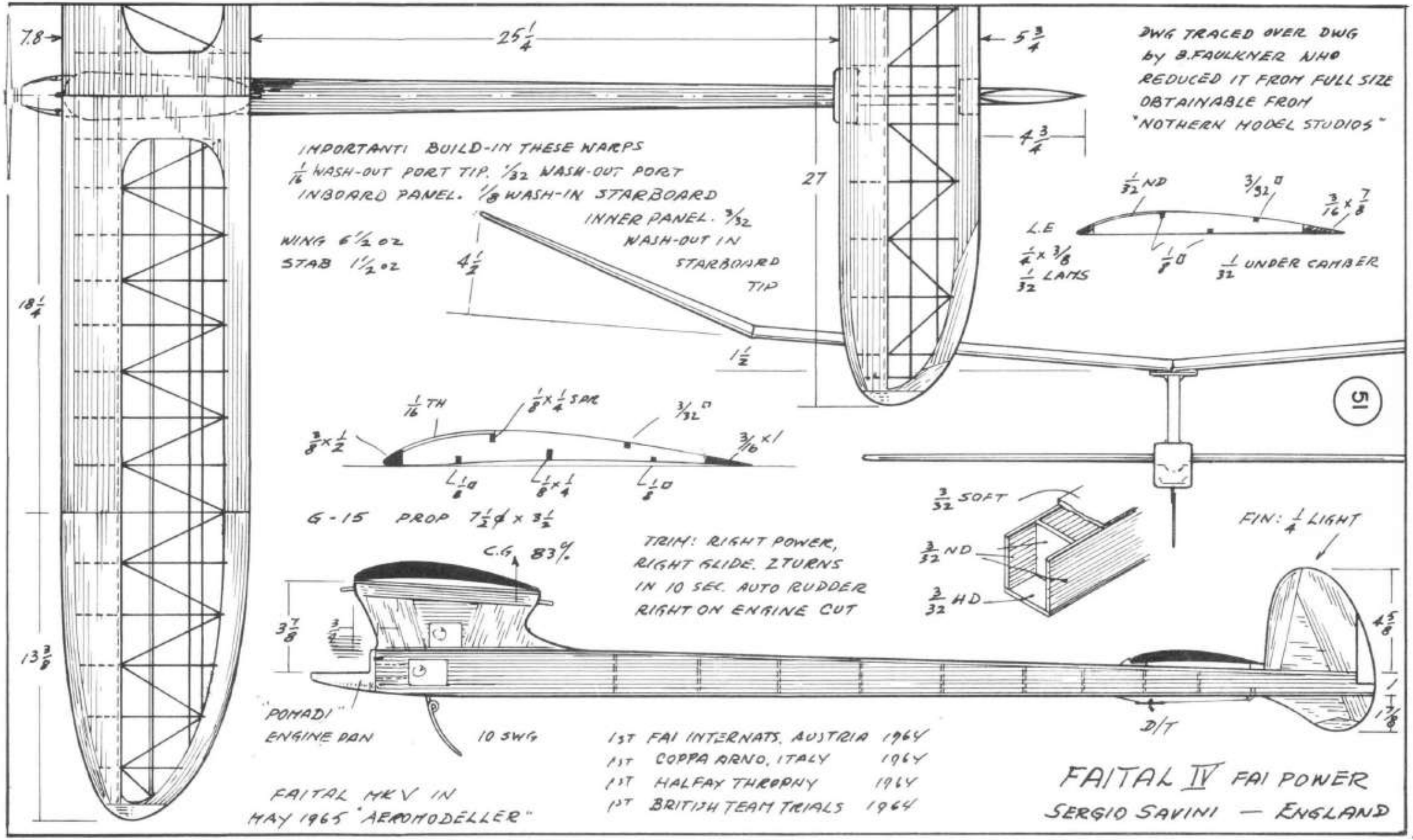
1 1/8° RIGHT
6.5x15
200
356
452
3x7 → 5
3x5
3x13
4x25
1.6
49
F. Zaic
AIRFOILS APPROX. FROM SMALL DWG.
630
125
5mm BALSA
3x10 → 5
HD. WD. (SPR?)
3.8°
86% C.G
3-5x10 SPR.
5mm BALSA
140
AUTO RUDDER
+2.4°
SUPER TIGRE G.20
65
1/2° DOWN
DURAL PLATE
3mm
5x5
25
110
30
FROM DWG. ORIGINALY IN "ILMAILU"
2mm PLY
5x5 SPR
75
3mm
2mm
6.5x32
10x12 MOTOR MOUNTS
664
FLOWN IN 1963 FAI BY
— LASSE LAXMAN —
FLY-OFF 5x180+210+240+233
50
35
150
RIST-RAST FAI POWER
REINO HYVARINEN. — FINLAND



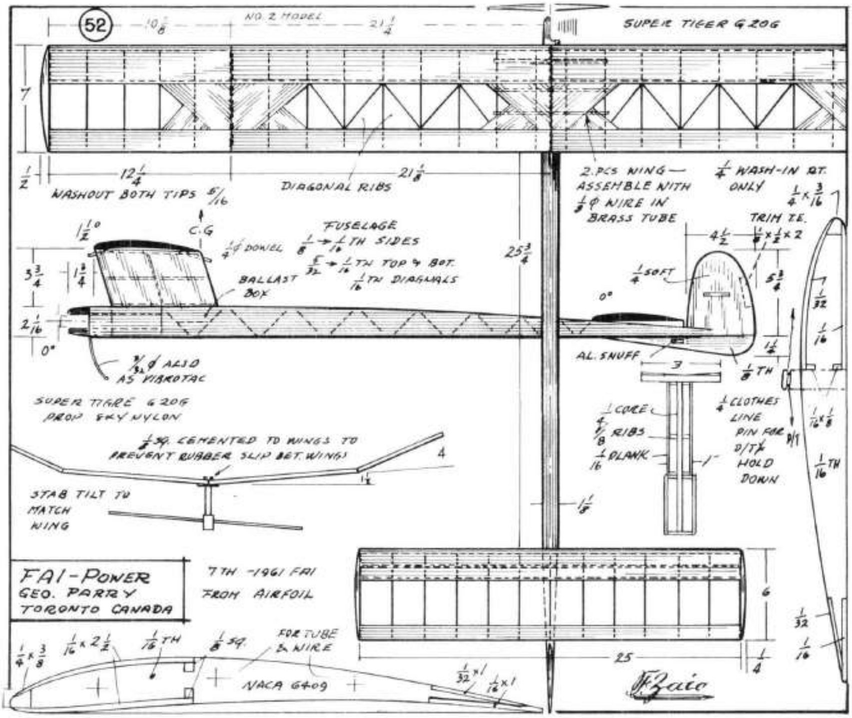
"BISCHERONE" F.A.I. POWER
GRIFONI GIANFRANCO - ITALY -

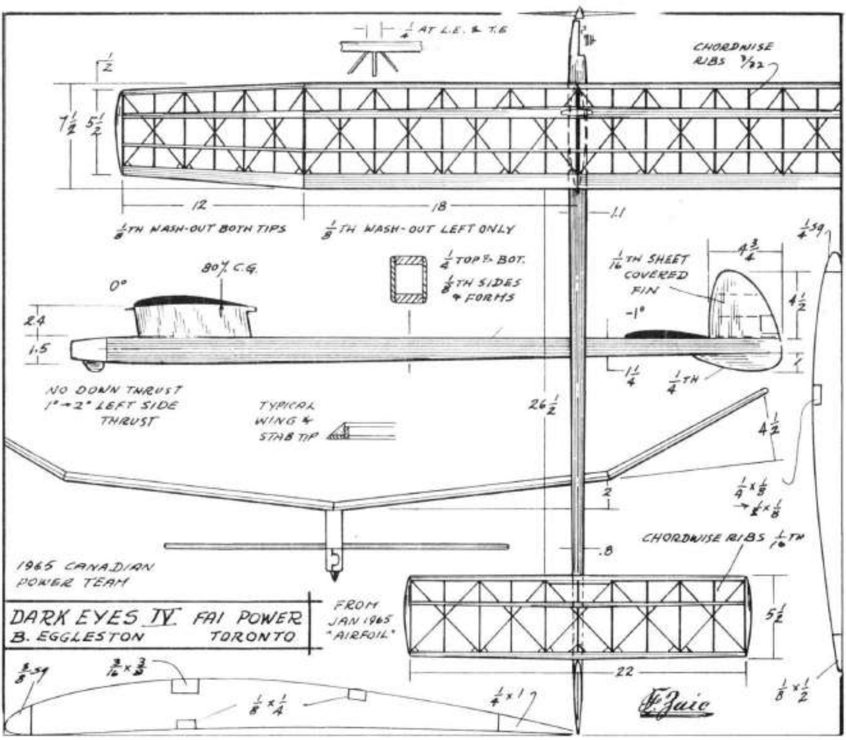


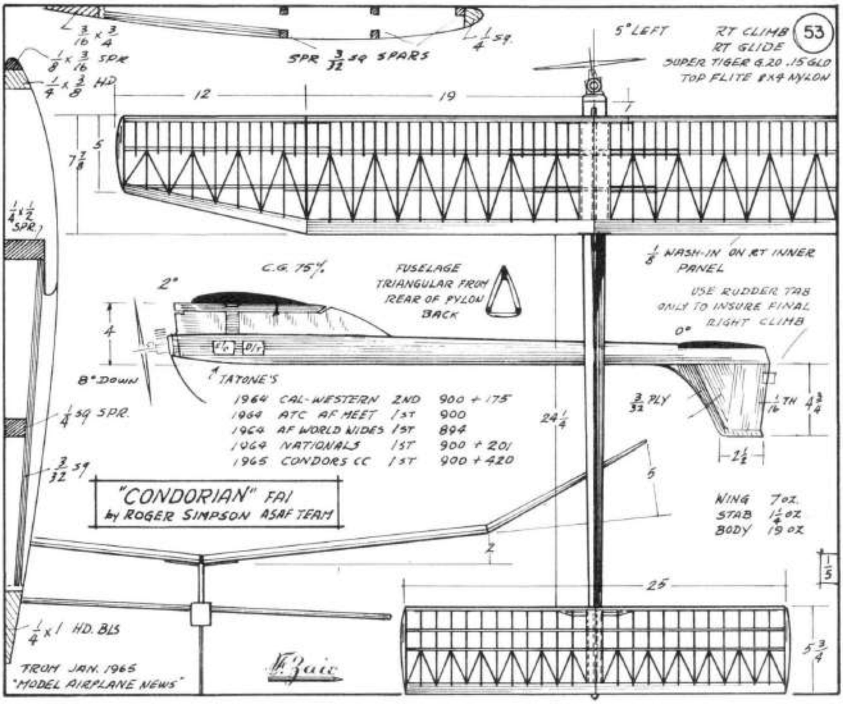
FAI - POWER MODEL
▸SONDA◂
BY ZDENĚK MALINA
CZECHOSLOVAKIA

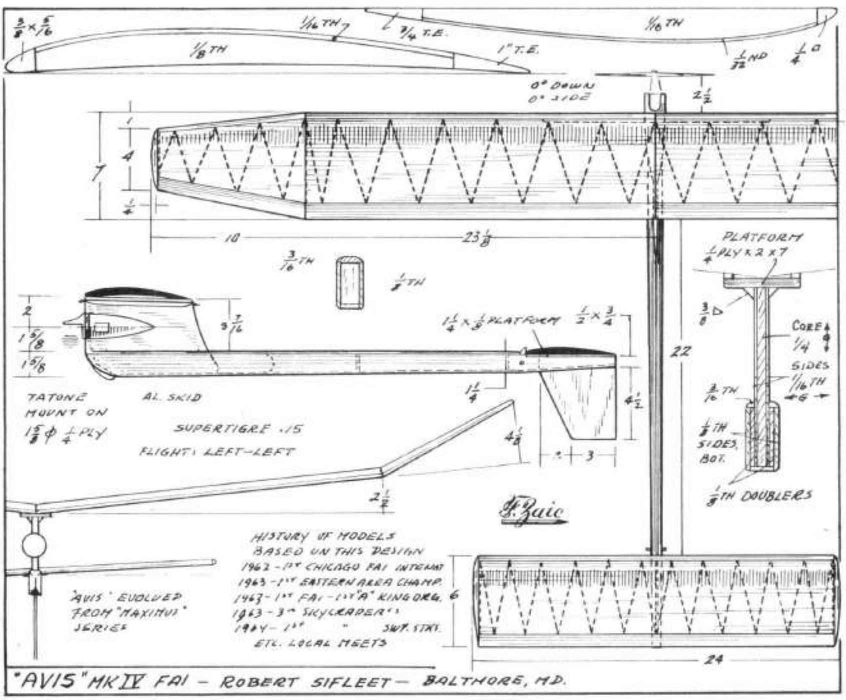


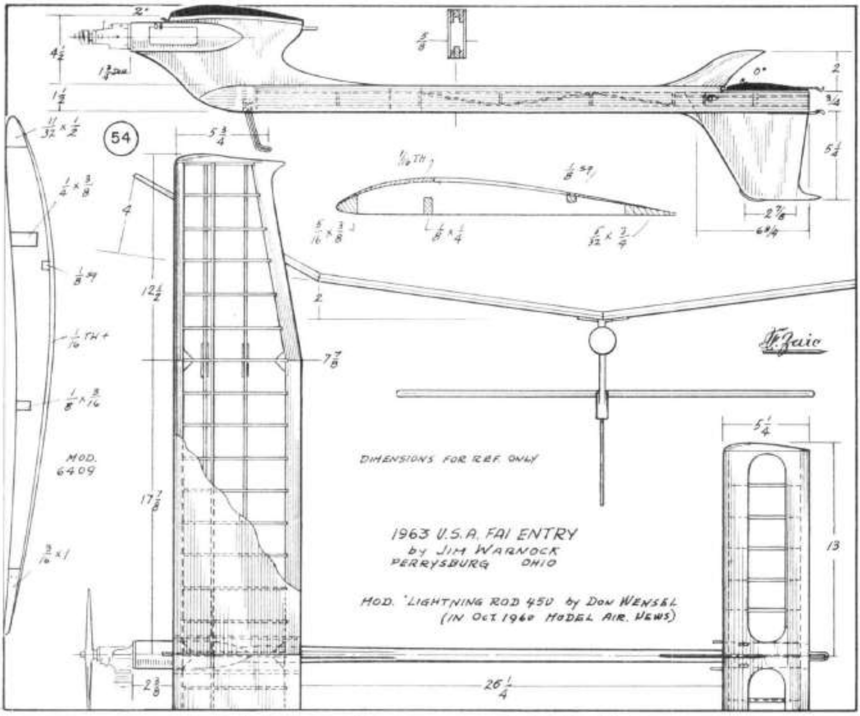
DWG TRACED OVER DWG
by B.FAULKNER WHO
REDUCED IT FROM FULL SIZE
OBTAINABLE FROM
"NOTHERN MODEL STUDIOS"
7.8
25 1/4
5 3/4
4 3/4
27
18 1/4
13 3/8
IMPORTANT! BUILD-IN THESE WARPS
1/16 WASH-OUT PORT TIP. 1/32 WASH-OUT PORT
INBOARD PANEL. 1/8 WASH-IN STARBOARD
INNER PANEL. 3/32
WASH-OUT IN
STARBOARD
TIP
WING 6 1/2 OZ
STAB 1 1/2 OZ
4 1/2
1 1/2
1/32 ND
3/32 □
3/16 x 7/8
L.E
1/4 x 3/8
1/32 LAMS
1/8 □
1/32 UNDER CAMBER
1/16 TH
1/8 x 1/4 SPAR
3/32 □
3/8 x 1/2
3/16 x 1
1/8 □
1/8 x 1/4
1/8 □
51
G-15 PROP 7 1/2 ⌀ x 3 1/2
C.G. 83%
TRIM: RIGHT POWER,
RIGHT GLIDE. 2 TURNS
IN 10 SEC. AUTO RUDDER
RIGHT ON ENGINE CUT
3/32 SOFT
3/32 ND
3/32 HD
FIN: 1/4 LIGHT
3 7/8
3/4
4 5/8
1
1 7/8
D/T
"POMADI"
ENGINE PAN
10 SWG
1ST FAI INTERNATS. AUSTRIA 1964
1ST COPPA ARNO. ITALY 1964
1ST HALFAX THROPHY 1964
1ST BRITISH TEAM TRIALS 1964
FAITAL MK V IN
MAY 1965 "AEROMODELLER"
FAITAL IV FAI POWER
SERGIO SAVINI — ENGLAND

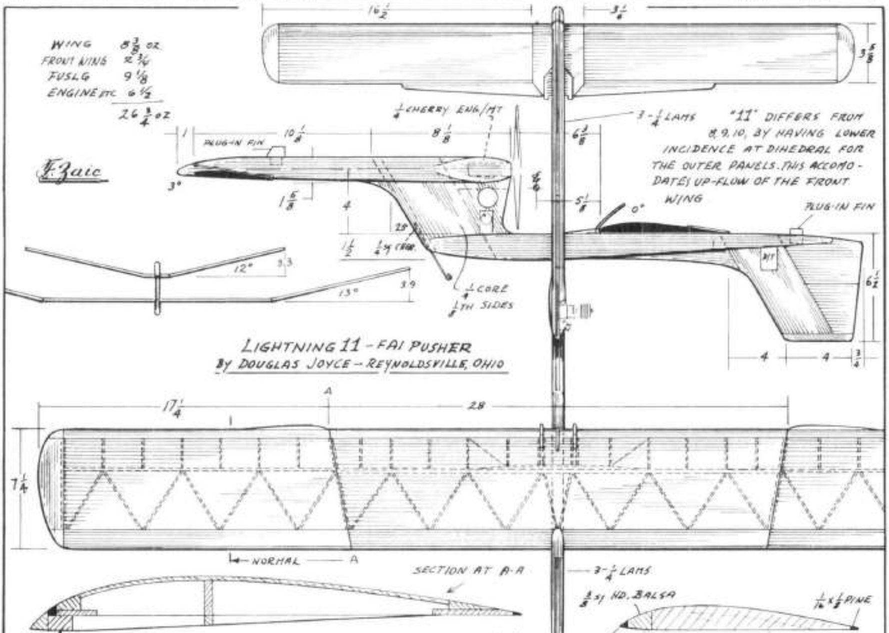

52
NO. 2 MODEL
SUPER TIGER G 20G
WASHOUT BOTH TIPS 5/16
DIAGONAL RIBS
2 PCS WING — ASSEMBLE WITH 1/8 φ WIRE IN BRASS TUBE
1/4 WASH-IN RT. ONLY
TRIM T.E.
C.G
1/4 φ DOWEL
FUSELAGE
1/8 → 1/16 TH SIDES
5/32 → 1/16 TH TOP & BOT.
1/16 TH DIAGONALS
BALLAST BOX
1/4 SOFT
AL. SNUFF
3/32 φ ALSO AS VIBROTAC
SUPER TIGRE G 20G
PROP 5KY NYLON
1/8 SQ. CEMENTED TO WINGS TO PREVENT RUBBER SLIP BET. WINGS
1/4 CORE
1/8 RIBS
1/16 PLANK
1/4 CLOTHES LINE PIN FOR D/T & HOLD DOWN
STAB TILT TO MATCH WING
FAI-POWER
GEO. PARRY
TORONTO CANADA
7TH - 1961 FAI
FROM AIRFOIL
FOR TUBE & WIRE
NACA 6409
F. Zaic

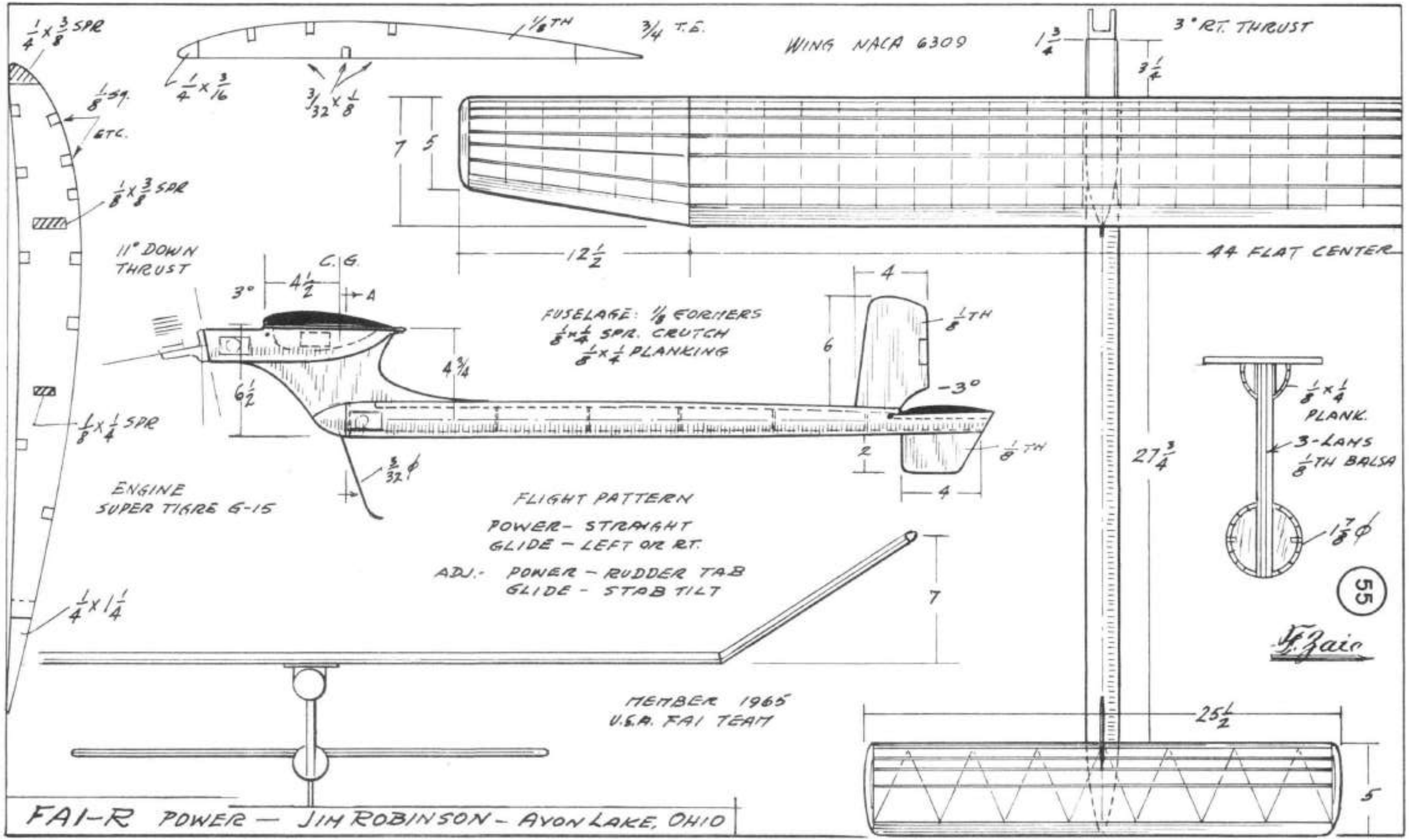

1/4 AT L.E. & T.E.
CHORDWISE RIBS 3/32
1/8 TH WASH-OUT BOTH TIPS
1/8 TH WASH-OUT LEFT ONLY
80% C.G.
1/4 TOP & BOT.
1/8 TH SIDES & FORMS
1/16 TH SHEET COVERED FIN
NO DOWN THRUST
1° → 2° LEFT SIDE THRUST
TYPICAL WING & STAB TIP
CHORDWISE RIBS 1/16 TH
1965 CANADIAN POWER TEAM
DARK EYES IV FAI POWER
B. EGGLESTON TORONTO
FROM JAN 1965 "AIRFOIL"
F. Zaic

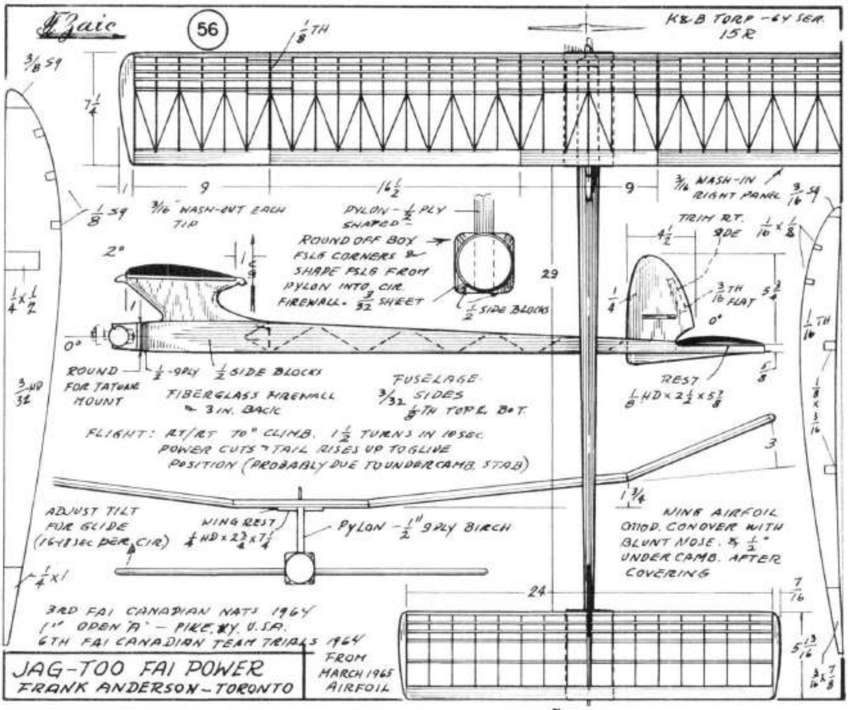

53
RT CLIMB
RT GLIDE
SUPER TIGER G.20 .15 GLO
TOP FLITE 8X4 NYLON
5° LEFT
SPR 3/32 SQ SPARS
1/4 SQ.
3/16 x 3/4
1/8 x 3/16 SPR
1/4 x 3/8 HD
12
19
5
7 7/8
1/4 x 1/2 SPR.
1/8 WASH-IN ON RT INNER PANEL
C.G. 75%
FUSELAGE TRIANGULAR FROM REAR OF PYLON BACK
USE RUDDER TAB ONLY TO INSURE FINAL RIGHT CLIMB
2°
0°
4
8° DOWN
TATONE'S
3/32 PLY
1/16 TH
4 3/4
2 1/2
24 1/4
1/4 SQ SPR.
3/32 SQ
1964 CAL-WESTERN 2ND 900 + 175
1964 ATC AF MEET 1ST 900
1964 AF WORLD WIDES 1ST 894
1964 NATIONALS 1ST 900 + 201
1965 CONDORS CC 1ST 900 + 420
"CONDORIAN" FAI
by ROGER SIMPSON ASAF TEAM
5
2
WING 7 oz.
STAB 1 1/4 oz
BODY 19 oz
25
1/5
5 3/4
1/4 x 1 HD. BLS
FROM JAN. 1965 "MODEL AIRPLANE NEWS"
F. Zaic


3/8 x 5/16
1/16 TH
1/8 TH
3/4 T.E.
1" T.E.
1/16 TH
1/32 ND
1/4 a
0° DOWN
0° SIDE
2 1/2
1
4
7
1/4
10
23 1/8
3/16 TH
1/8 TH
PLATFORM 1/4 PLY x 2 x 7
2
1 5/8
1 5/8
3 7/16
1 1/4 x 1/8 PLATFORM
1/2 x 3/4
3/8 D
CORE 1/4
SIDES 1/16 TH
22
TATONE MOUNT ON 1 5/8 φ 1/4 PLY
AL. SKID
SUPERTIGRE .15
FLIGHT: LEFT-LEFT
1 1/4
4 1/2
4 1/8
3
3/16 TH
1/8 TH SIDES, BOT.
1/8 TH DOUBLERS
2 1/2
F. Zaic
HISTORY OF MODELS BASED ON THIS DESIGN
1962 - 1ST CHICAGO FAI INTERNAT
1963 - 1ST EASTERN AREA CHAMP.
1963 - 1ST FAI - 1ST "A" KING ORG.
1963 - 3RD SKYSCRAPERS
1964 - 1ST " SWT. STKS.
ETC. LOCAL MEETS
6
"AVIS" EVOLVED FROM "MAXIMUS" SERIES
24
"AVIS" MK IV FAI - ROBERT SIFLEET - BALTIMORE, MD.

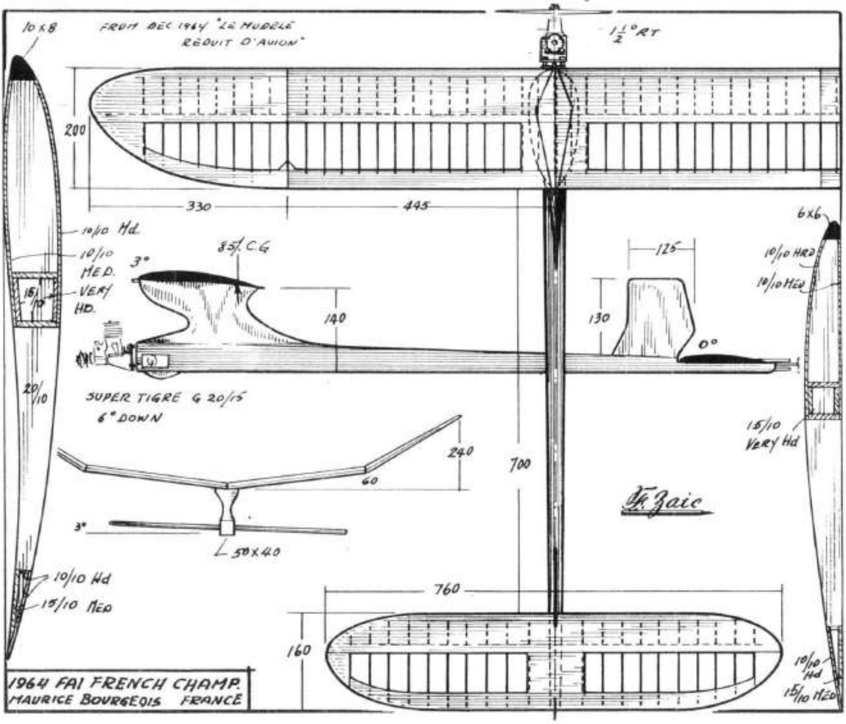

54
MOD.
6409
DIMENSIONS FOR REF. ONLY
1963 U.S.A. FAI ENTRY
by JIM WARNOCK
PERRYSBURG OHIO
MOD. 'LIGHTNING ROD 450' by DON WENSEL
(IN OCT. 1960 MODEL AIR NEWS)
F. Zaic


WING 8 3/8 OZ
FRONT WING 2 3/4
FUSLG 9 1/8
ENGINE ETC 6 1/2
26 3/4 OZ
F. Zaic
PLUG-IN FIN
1/4 CHERRY ENG/MT
3 - 1/4 LAMS
"11" DIFFERS FROM 8, 9, 10, BY HAVING LOWER INCIDENCE AT DIHEDRAL FOR THE OUTER PANELS. THIS ACCOMO-DATES UP-FLOW OF THE FRONT WING
PLUG-IN FIN
1/4 CORE
1/16 TH SIDES
LIGHTNING 11 - FAI PUSHER
BY DOUGLAS JOYCE - REYNOLDSVILLE, OHIO
NORMAL
SECTION AT A-A
3 - 1/4 LAMS
1/8 SQ HD. BALSA
1/16 x 1/8 PINE
1/8 SQ PINE
FRONT WING
3/8 x 3 SHEET
1/8 x 1/2 SPARS
NORMAL
1/16 x 1/8 PINE

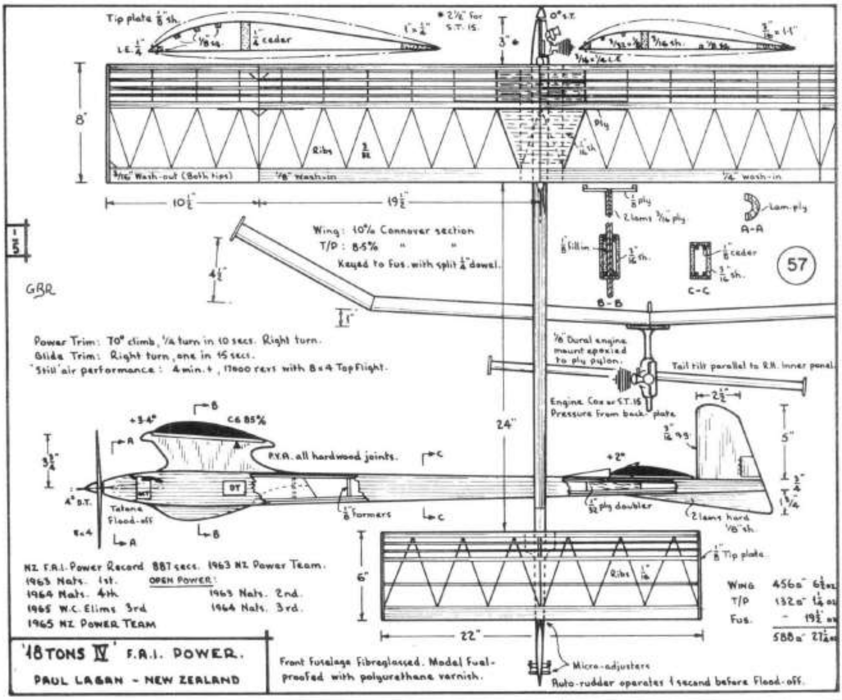

1/4 x 3/8 SPR
1/8 SQ.
ETC.
1/8 x 3/8 SPR
1/8 x 1/4 SPR
1/4 x 1 1/4
1/4 x 3/16
3/32 x 1/8
1/8 TH
3/4 T.E.
WING NACA 6309
1 3/4
3 1/4
3° RT. THRUST
7
5
12 1/2
44 FLAT CENTER
11° DOWN THRUST
3°
4 1/2
C.G.
A
4 3/4
6 1/2
3/32 ϕ
FUSELAGE: 1/8 FORMERS
1/8 x 1/4 SPR. CRUTCH
1/8 x 1/4 PLANKING
4
6
1/8 TH
-3°
2
1/8 TH
4
ENGINE
SUPER TIGRE G-15
FLIGHT PATTERN
POWER - STRAIGHT
GLIDE - LEFT OR RT.
ADJ.- POWER - RUDDER TAB
GLIDE - STAB TILT
7
27 3/4
1/8 x 1/4
PLANK.
3-LAMS
1/8 TH BALSA
1 7/8 ϕ
55
MEMBER 1965
U.S.A. FAI TEAM
25 1/2
5
FAI-R POWER — JIM ROBINSON - AVON LAKE, OHIO



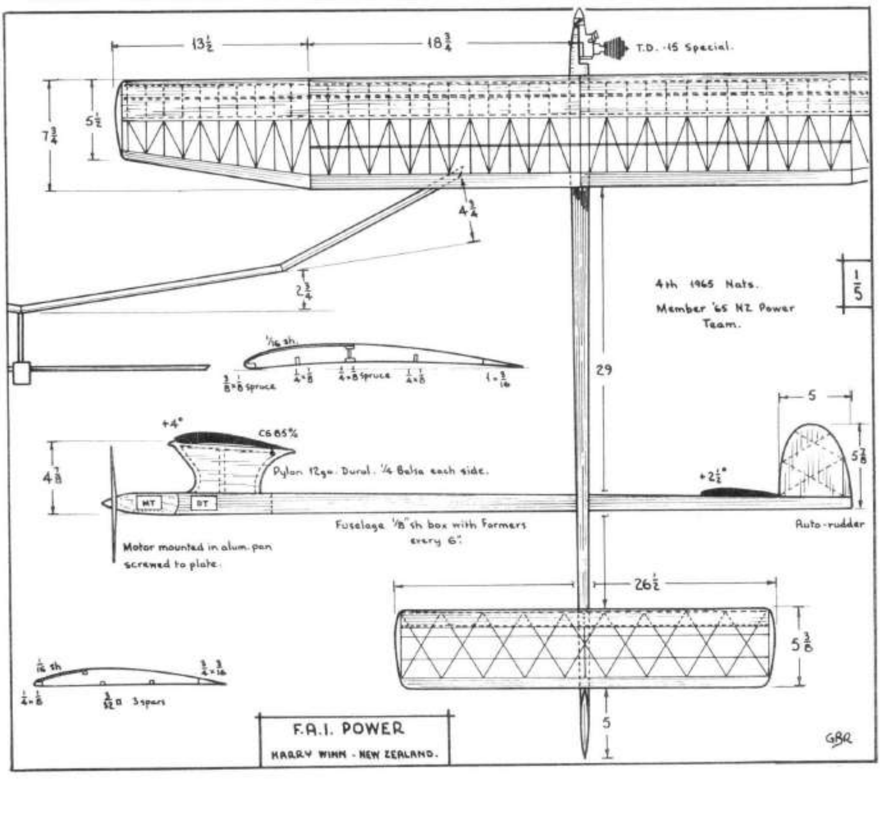
56
K&B TORP -64 SER. 15R
3/8 SQ
1/8 TH
3/16 WASH-OUT EACH TIP
3/16 WASH-IN RIGHT PANEL
PYLON - 1/2 PLY SHAPED
ROUND OFF BOX FSLG CORNERS & SHAPE FSLG FROM PYLON INTO CIR. FIREWALL. 3/32 SHEET
1/2 SIDE BLOCKS
TRIM RT. SIDE
3/16 TH FLAT
ROUND FOR TATONE MOUNT
1/2-9PLY
1/2 SIDE BLOCKS
FIBERGLASS FIREWALL & 3 IN. BACK
FUSELAGE 3/32 SIDES 1/8 TH TOP & BOT.
REST 1/8 HD x 2 1/2 x 5 7/8
FLIGHT: RT/RT 70° CLIMB. 1 1/2 TURNS IN 10 SEC. POWER CUTS - TAIL RISES UP TO GLIDE POSITION (PROBABLY DUE TO UNDERCAMB. STAB)
ADJUST TILT FOR GLIDE (16-18 SEC PER CIR)
WING REST 1/4 HD x 2 3/4 x 7 1/4
Pylon - 1/2" 9 PLY BIRCH
WING AIRFOIL MOD. CONOVER WITH BLUNT NOSE. & 1/2" UNDER CAMB. AFTER COVERING
3RD FAI CANADIAN NATS 1964
1ST OPEN "A" - PIKE, N.Y. U.S.A.
6TH FAI CANADIAN TEAM TRIALS 1964
JAG-TOO FAI POWER
FRANK ANDERSON - TORONTO
FROM MARCH 1965 AIRFOIL



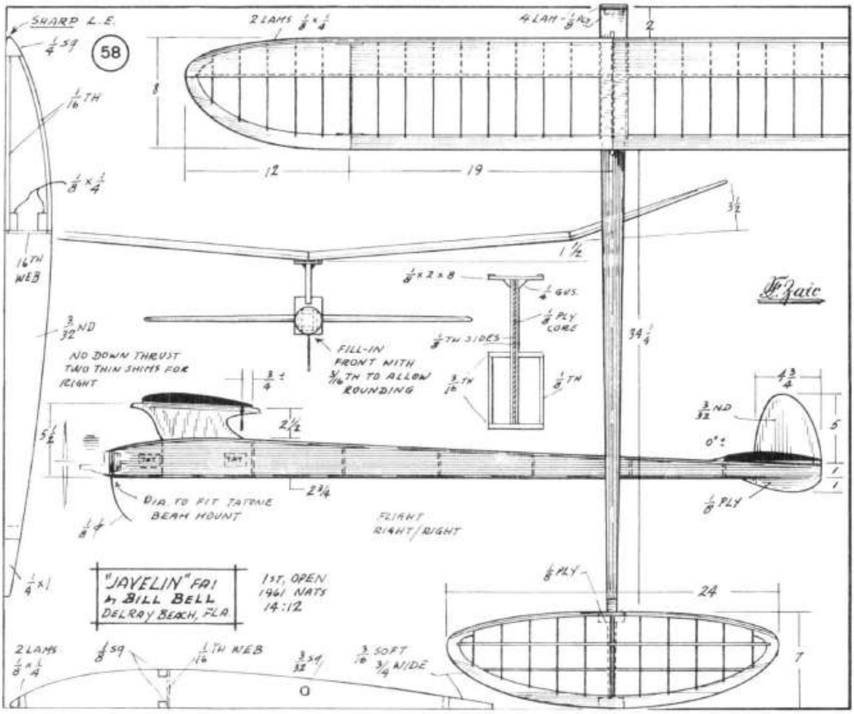
10x8
FROM DEC 1964 "LE MODELE REDUIT D'AVION"
1 1/2° RT
200
330
445
10/10 Hd
10/10 MED.
15/10 VERY HD.
85% C.G
140
125
130
0°
6x6
10/10 HRD
10/10 MED
20/10
SUPER TIGRE G 20/15
6° DOWN
240
60
700
15/10 Very Hd
50x40
10/10 Hd
15/10 MED
760
160
1964 FAI FRENCH CHAMP.
MAURICE BOURGEOIS FRANCE



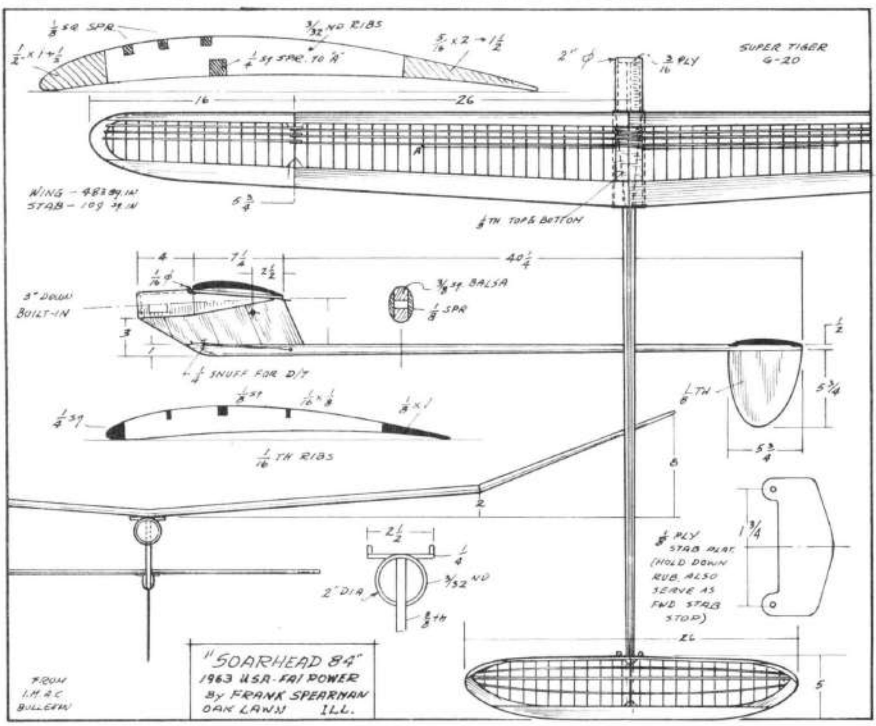
'18 TONS IV' F.A.I. POWER.
PAUL LAGAN - NEW ZEALAND
57
GBR
Tip plate 1/8 sh.
L.E. 1/4
1/4 ceder
1 x 1/4
2 1/2 for S.T. 15.
0° S.T.
3"
8"
1/16 Wash-out (Both tips)
1/8 Wash-in
1/4 wash-in
Ribs
Ply
10 1/2"
19 1/2"
Wing: 10% Connover section
T/P: 8.5%
Keyed to Fus. with split 1/4 dowel.
4 1/2"
1"
1/8 ply
2 lams 3/16 ply
Lam-ply
A-A
B-B
C-C
1/8 ceder
3/16 sh.
Power Trim: 70° climb, 1/4 turn in 10 secs. Right turn.
Glide Trim: Right turn, one in 15 secs.
'Still' air performance: 4 min.+, 17000 revs with 8x4 Top Flight.
1/8 Dural engine mount epoxied to ply pylon.
Tail tilt parallel to R.H. inner panel.
Engine Cox or S.T. 15
Pressure from back-plate
24"
+3-4°
C6 85%
P.V.A. all hardwood joints.
+2°
3 3/4"
4° D.T.
Tatone Flood-off
8x4
1/8 formers
3/32 ply doubler
2 lams hard 1/8 sh.
2 1/2"
5"
3/4"
1 3/4"
1/8 Tip plate
6"
22"
NZ F.A.I. Power Record 881 secs. 1963 NZ Power Team.
1963 Nats. 1st.
1964 Nats. 4th
1965 W.C. Elims 3rd
1965 NZ POWER TEAM
OPEN POWER:
1963 Nats. 2nd.
1964 Nats. 3rd.
Wing 456□" 6 1/2 oz
T/P 132□" 1 1/4 oz
Fus. - 19 1/2 oz
588□" 27 1/4 oz
Front Fuselage Fibreglassed. Model fuel-proofed with polyurethane varnish.
Micro-adjusters
Auto-rudder operates 1 second before Flood-off.



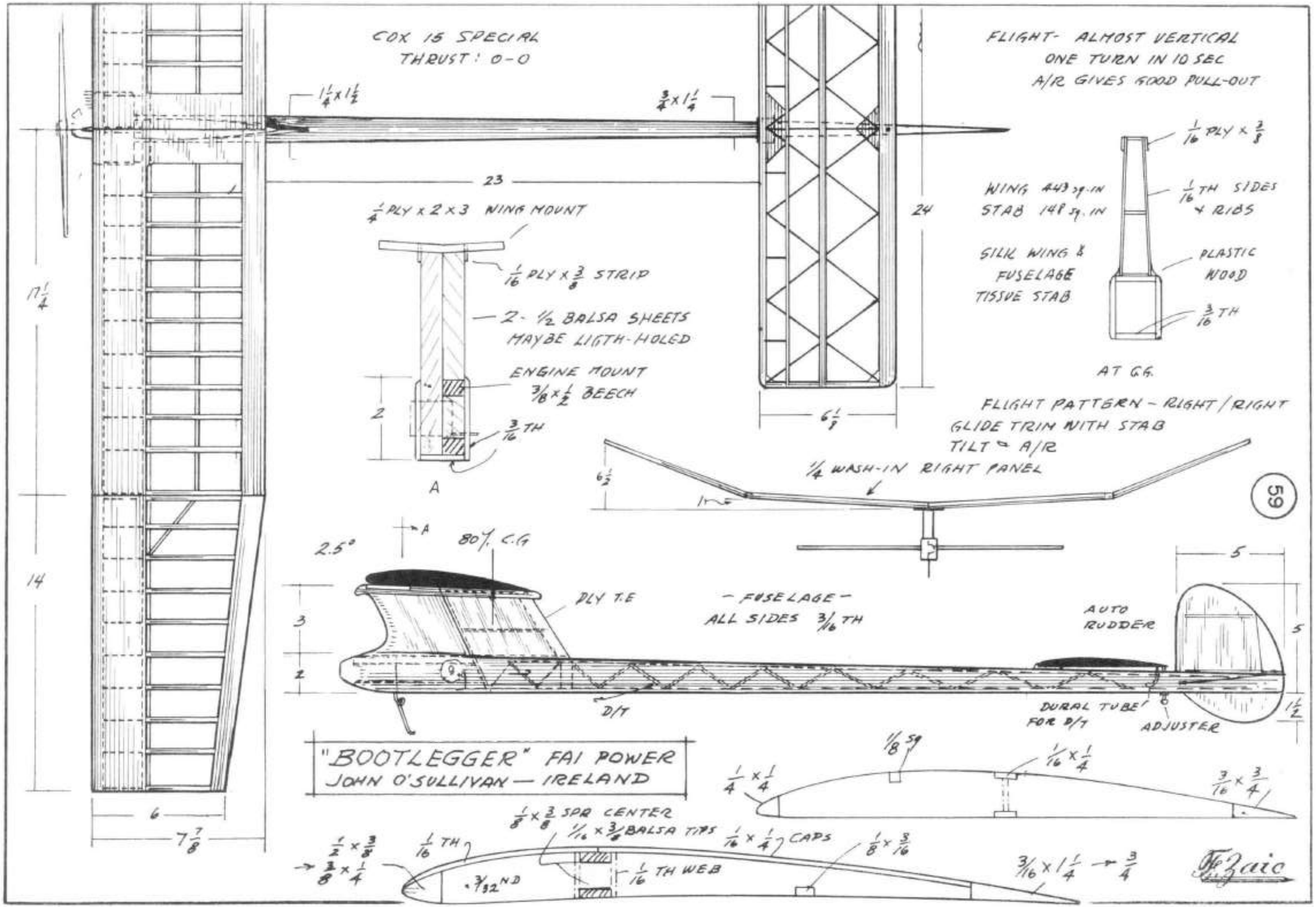
F.A.I. POWER
HARRY WINN - NEW ZEALAND.
GBR
13 1/2
18 3/4
T.D. .15 Special.
7 3/4
5 1/2
4 3/4
2 3/4
4th 1965 Nats.
Member '65 NZ Power Team.
1/5
1/16 sh.
3/8 x 1/8 spruce
1/4 x 1/8
1/4 x 1/8 spruce
1 x 3/16
29
+4°
C6 85%
4 7/8
Pylon 12ga. Dural. 1/4 Balsa each side.
MT
DT
+2 1/2°
5
5 7/8
Fuselage 1/8 sh box with formers every 6".
Auto-rudder
Motor mounted in alum. pan screwed to plate.
26 1/2
5 3/8
1/16 sh
1/4 x 1/8
3/32 □ 3 spars
1/4 x 3/16



58
"JAVELIN" FAI
by BILL BELL
DELRAY BEACH, FLA.
1ST, OPEN
1961 NATS
14:12
SHARP L.E.
2 LAMS
16TH WEB
NO DOWN THRUST
TWO THIN SHIMS FOR RIGHT
FILL-IN FRONT WITH 3/16 TH TO ALLOW ROUNDING
DIA. TO FIT TATONE BEAM MOUNT
FLIGHT RIGHT/RIGHT
F. Zaic



"SOARHEAD 84"
1963 USA-FAI POWER
By FRANK SPEARMAN
OAK LAWN ILL.
SUPER TIGER G-20
WING - 483 sq. in
STAB - 109 sq. in
3° DOWN BUILT-IN
SNUFF FOR D/T
TH RIBS
TH TOP & BOTTOM
2" DIA.
STAB PLAT. (HOLD DOWN RUB. ALSO SERVE AS FWD. STAB STOP)
FROM I.H.R.C. BULLETIN



COX 15 SPECIAL
THRUST: 0-0
FLIGHT- ALMOST VERTICAL
ONE TURN IN 10 SEC
A/R GIVES GOOD PULL-OUT
1/16 PLY x 3/8
WING 443 sq. in
STAB 148 sq. in
1/16 TH SIDES & RIBS
SILK WING & FUSELAGE
TISSUE STAB
PLASTIC WOOD
3/16 TH
AT C.G.
1/4 x 1 1/2
3/4 x 1 1/4
23
24
1/4 PLY x 2 x 3 WING MOUNT
1/16 PLY x 3/8 STRIP
2- 1/2 BALSA SHEETS
MAYBE LIGTH-HOLED
ENGINE MOUNT
3/8 x 1/2 BEECH
3/16 TH
2
A
6 1/8
FLIGHT PATTERN - RIGHT/RIGHT
GLIDE TRIM WITH STAB
TILT & A/R
1/4 WASH-IN RIGHT PANEL
6 1/2
1
59
17 1/4
14
2.5°
80% C.G
PLY T.E
- FUSELAGE -
ALL SIDES 3/16 TH
AUTO RUDDER
5
5
3
2
D/T
DURAL TUBE FOR D/T
ADJUSTER
1 1/2
"BOOTLEGGER" FAI POWER
JOHN O'SULLIVAN — IRELAND
6
7 7/8
1/8 sq
1/4 x 1/4
1/16 x 1/4
3/16 x 3/4
1/8 x 3/8 SPR CENTER
1/16 x 3/8 BALSA TIPS
1/16 x 1/4 CAPS
1/8 x 3/16
1/2 x 3/8
3/8 x 1/4
1/16 TH
3/32 ND
1/16 TH WEB
3/16 x 1 1/4 → 3/4
F. Zaic

FAI VIPER

V. H. Ure Canada

In my search for a FAI Power design I decided to compromise. The Hi-Thrust designs are popular with Open Class where light weight is the rule, while in FAI the majority seem to be of pylon type. Since I do not like either type, I used the Center Thrust layout.

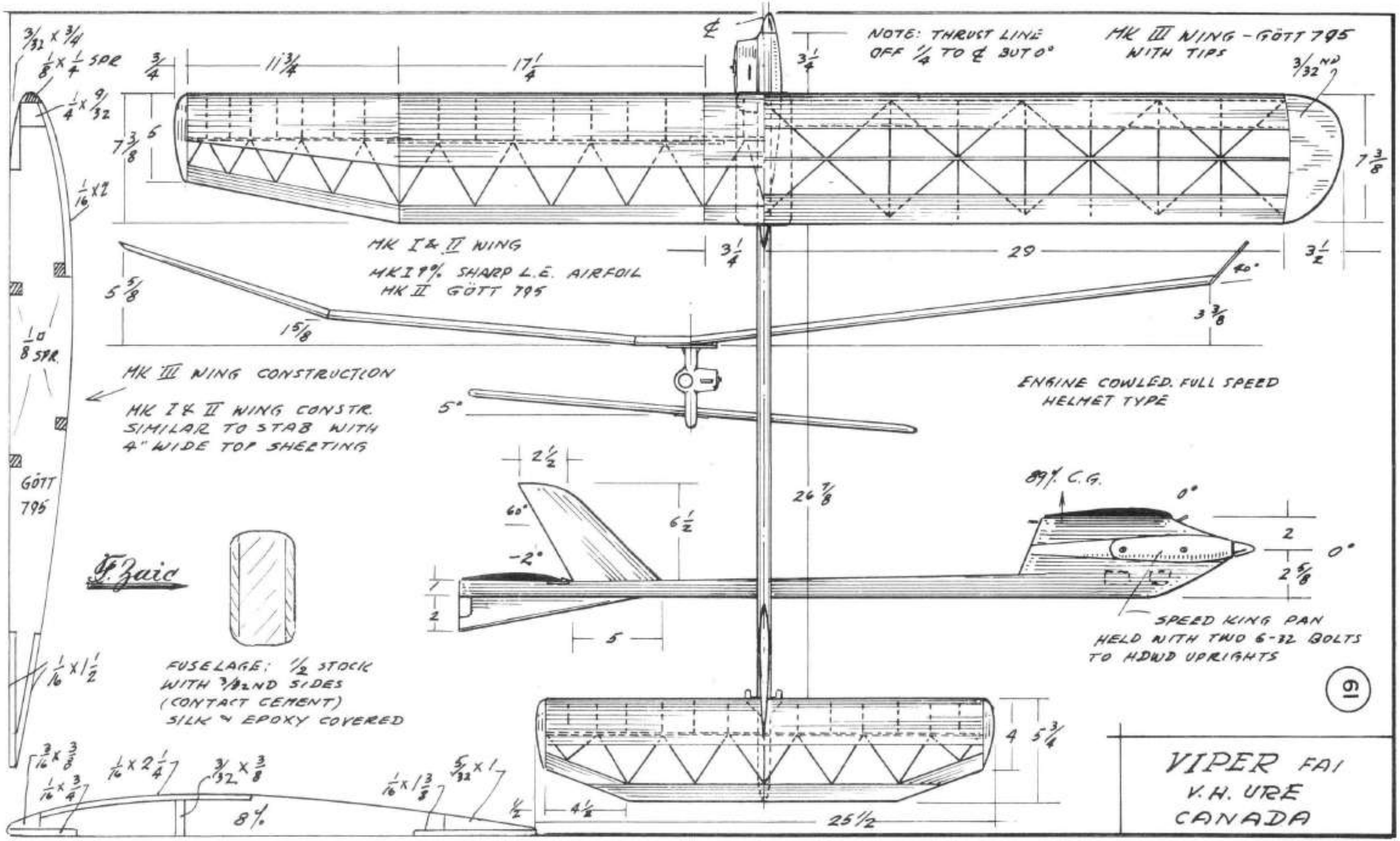
I had an ST. 15 in an FAI Speed model, and in Fall of 1963 decided to use the Speed King pan for the FF. The pan was mounted on hardwood motor mount stock running vertically in the pylon structure, held in place with two 6-32 bolts. To clean up the other side, a speed cowl was installed. It was hoped that the cowl would keep the engine clean while flying over the plowed fields prevalent in our area.

MK 1 had 9% section with sharp L.E. It flew very well and was used throughout 1964. To obtain better still air performance, an identical model but with Gott 795 section was built. MK 2 had an honest average of over three minutes. Both models had good pattern, recovery and flat glide.

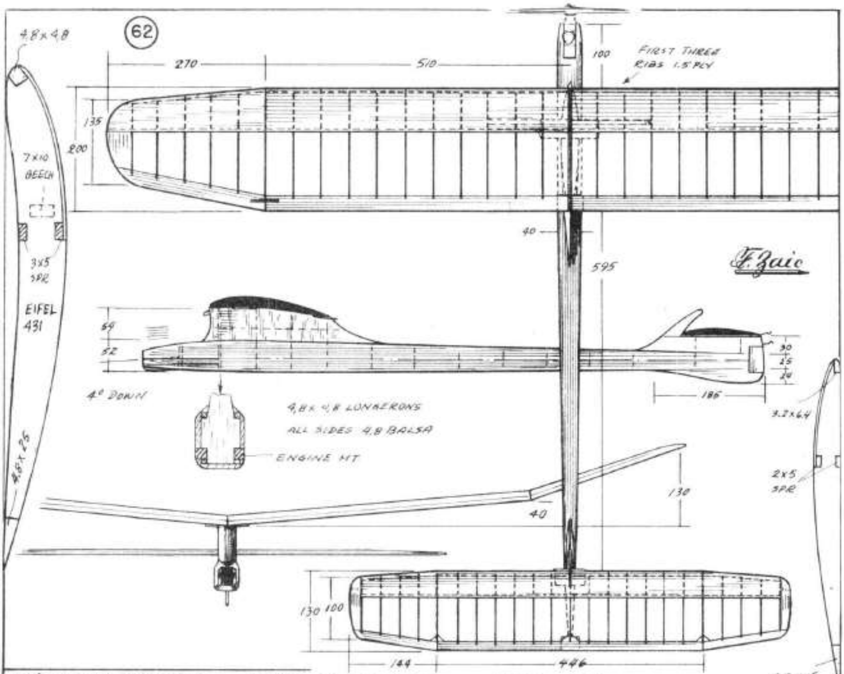
Then I built a 120 sq. in. TD .020 powered model with straight dihedral and short sheet tips angled 40°. This wing worked so well on the little Viper that it was decided to build an FAI version. The MK 3 is the result.

MK 3 is very stable and has improved the performance of the Viper quite a bit in climb and glide. Even the power pattern is better, for some unexplained reason. This version has flown in all kinds of weather, from ideal to 40 mph wind and pouring rain. No power problems that could not be corrected with a trim tab.

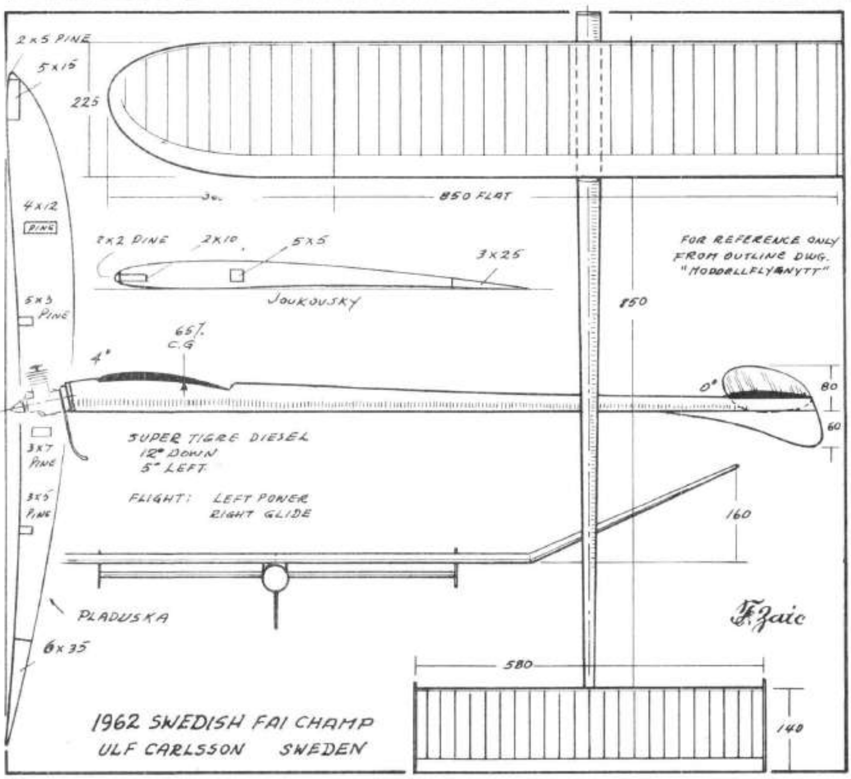
The Speed King pan has proven to be an excellent way to control the vibrations. And it has the advantage that by just removing two screws the whole assembly, with exception of timer and flood-off line, can be taken off. Makes trouble shooting very easy. However, as you can see, thrust adjustments are fixed. The cowl has also proven to be a big help, especially when the model D.T.s into dust. Now using it on all my models. In short, MK 3 is a very easy model to fly. All I need is a little competition. I am the only FAI Power flier in the Winnipeg area. There are three of us here. One flies Nordic, the other Wakefields and I fly Power. We are a complete FAI team and have no one to fly against!



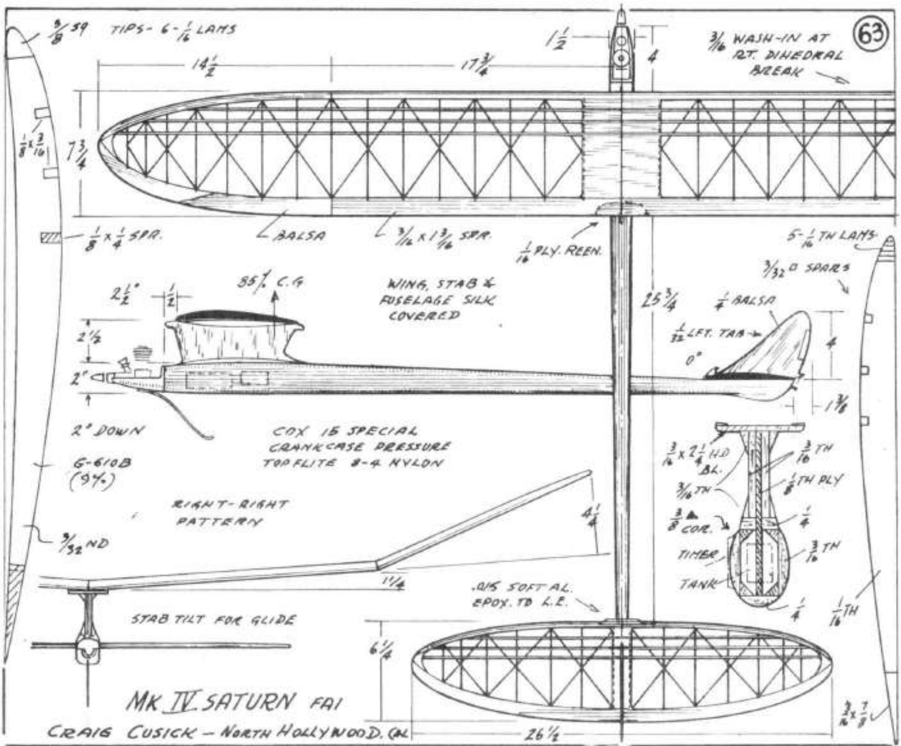
NOTE: THRUST LINE OFF 1/4 TO ℄ BUT 0°
MK III WING - GÖTT 795 WITH TIPS
3/32 x 3/4
1/8 x 1/4 SPR
1/4 x 9/32
1/16 x 2
1/8 SPR
GÖTT 795
1/16 x 1 1/2
3/16 x 3/8
1/16 x 3/4
1/16 x 2 1/4
3/32 x 3/8
8%
1/16 x 1 3/8
5/32 x 1
1/2
11 3/4
17 1/4
3/4
7 3/8
6
3 1/4
3/32 HD
7 3/8
MK I & II WING
MK I 9% SHARP L.E. AIRFOIL
MK II GÖTT 795
3 1/4
29
3 1/2
40°
5 5/8
1 5/8
3 3/8
MK III WING CONSTRUCTION
MK I & II WING CONSTR. SIMILAR TO STAB WITH 4" WIDE TOP SHEETING
5°
ENGINE COWLED. FULL SPEED HELMET TYPE
2 1/2
89% C.G.
0°
60°
6 1/2
26 7/8
-2°
2
0°
2 5/8
1
2
5
SPEED KING PAN HELD WITH TWO 6-32 BOLTS TO HDWD UPRIGHTS
F. Zaic
FUSELAGE: 1/2 STOCK WITH 3/32 HD SIDES (CONTACT CEMENT) SILK & EPOXY COVERED
4
5 3/4
4 1/2
25 1/2
VIPER FAI
V. H. URE
CANADA

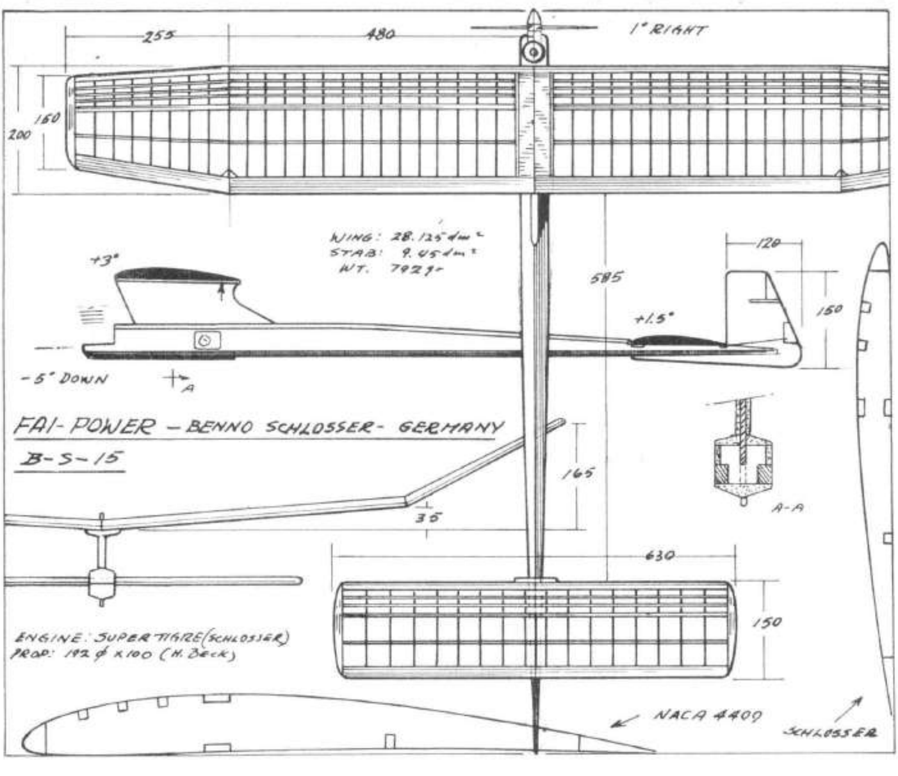


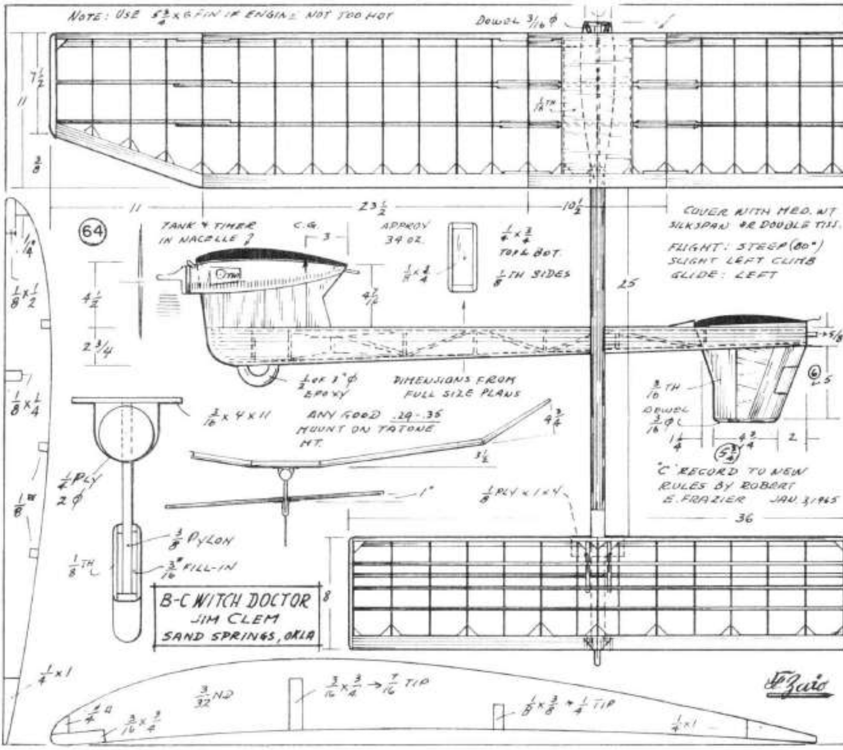
V/L1-MR DGAC — J.A.M. RAIMUNDO — PORTUGAL

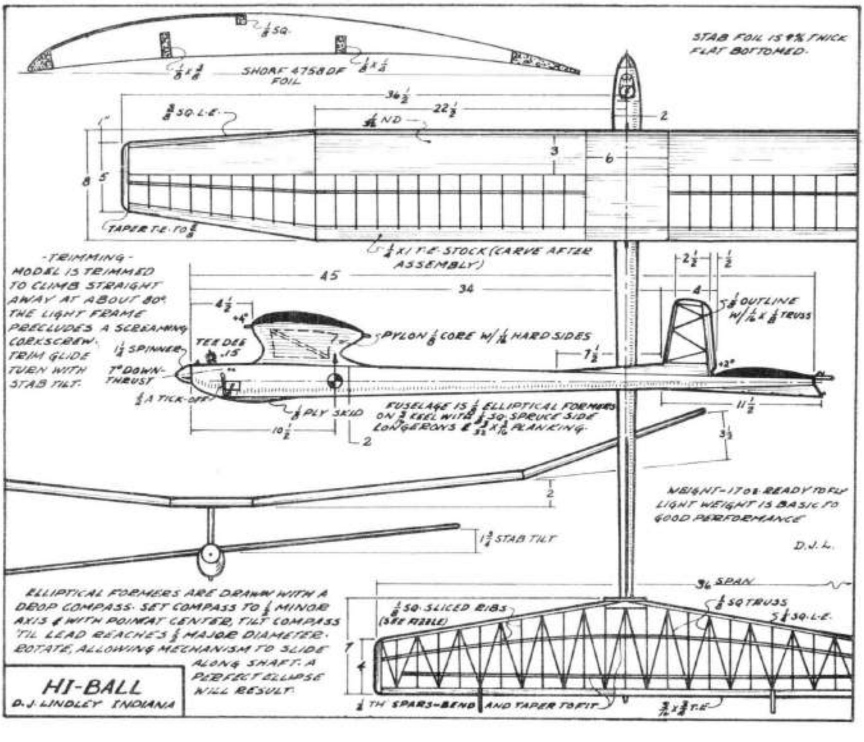


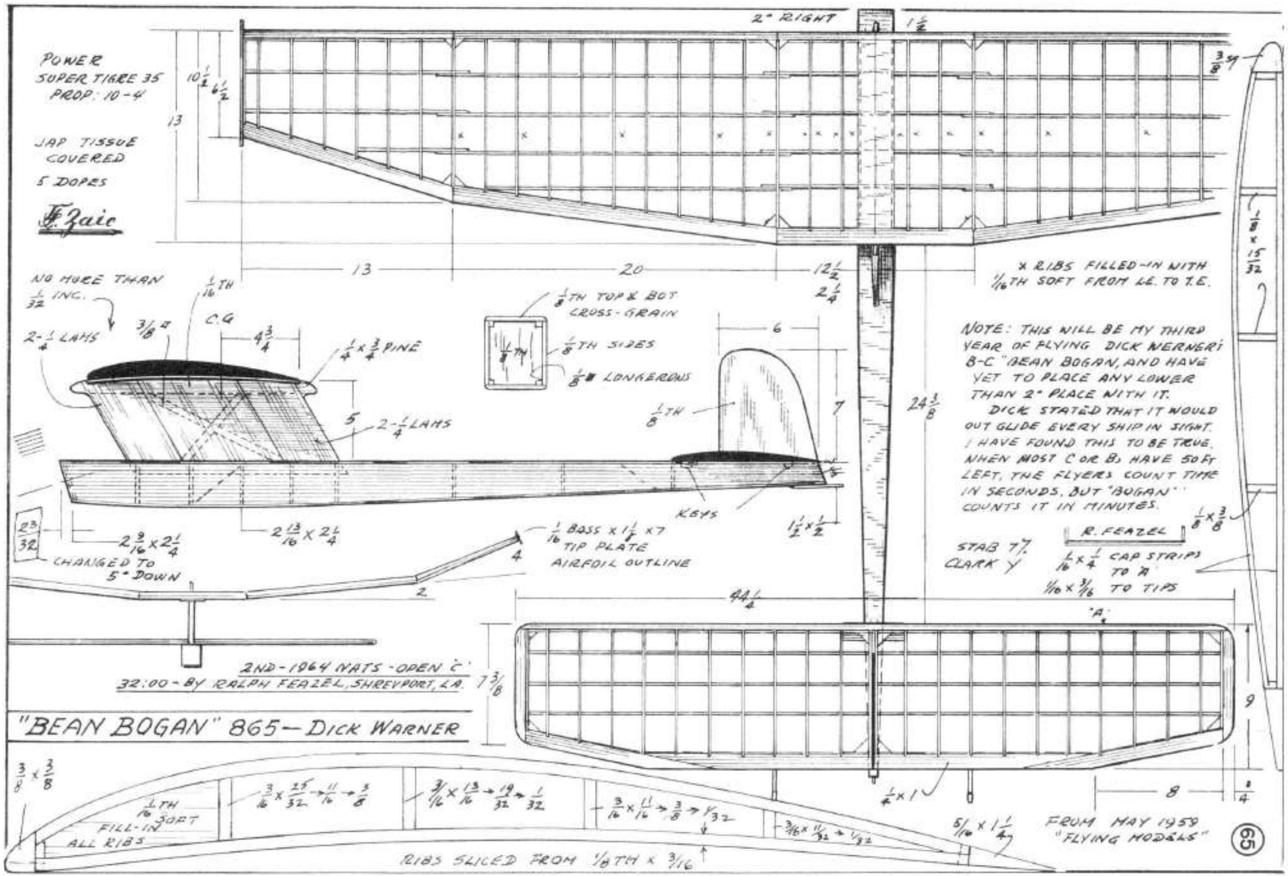
1962 SWEDISH FAI CHAMP
ULF CARLSSON SWEDEN


63
3/8 59
TIPS - 6 - 1/16 LAMS
14 1/2
17 3/4
1 1/2
4
3/16 WASH-IN AT
RT. DIHEDRAL
BREAK
1/8 x 3/16
7 3/4
1/8 x 1/4 SPR.
BALSA
3/16 x 1 3/16 SPR.
1/16 PLY. REEN.
5 - 1/16 TH LAMS
3/32 □ SPARS
85% C.G.
WING, STAB &
FUSELAGE SILK
COVERED
2 1/2"
1/2
2 1/2
2"
25 3/4
1/4 BALSA
1/32 LFT. TAB
0°
4
1 3/8
2" DOWN
COX 15 SPECIAL
CRANKCASE PRESSURE
TOP FLITE 8-4 NYLON
G-610B
(9%)
3/16 x 2 1/4 HD BL.
3/16 TH
1/8 TH PLY
3/16 TH
3/8 COR.
1/4
TIMER
3/16 TH
TANK
1/4
RIGHT-RIGHT
PATTERN
4 1/4
3/32 ND
1 1/4
.015 SOFT AL.
EPOX. TO L.E.
STAB TILT FOR GLIDE
6 1/4
1/16 TH
MK IV SATURN FAI
CRAIG CUSICK - NORTH HOLLYWOOD, CAL
26 1/2
3/16 x 7/8

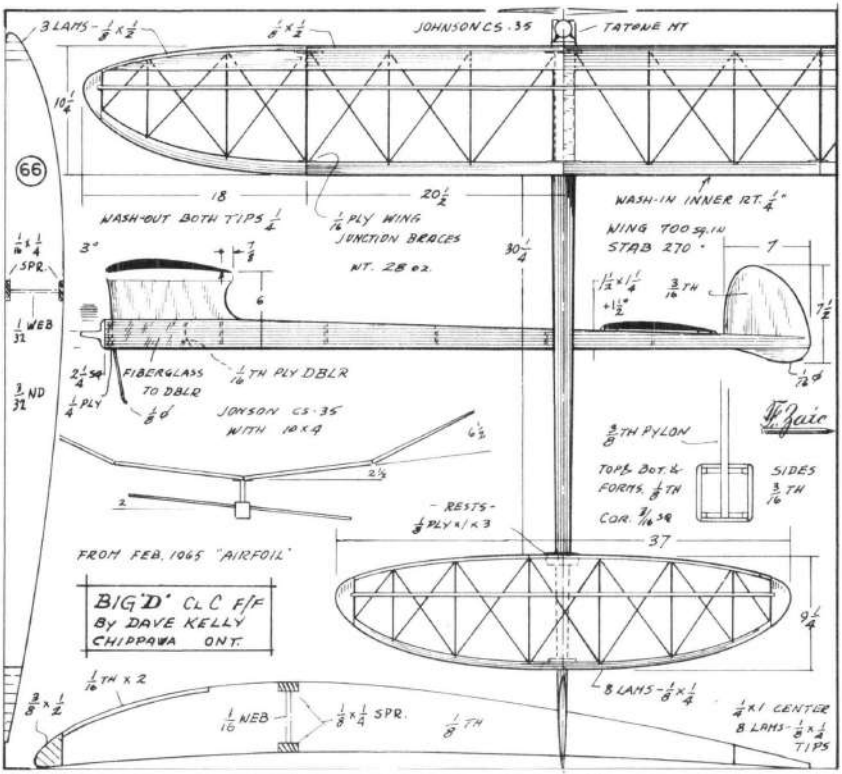

255
480
1° RIGHT
160
200
WING: 28.125 dm²
STAB: 9.45 dm²
WT. 792 g
+3°
585
120
+1.5°
150
-5° DOWN
A
FAI-POWER - BENNO SCHLOSSER - GERMANY
B-S-15
165
A-A
35
630
150
ENGINE: SUPER TIGRE (SCHLOSSER)
PROP: 192 ø x 100 (H. BECK)
NACA 4409
SCHLOSSER

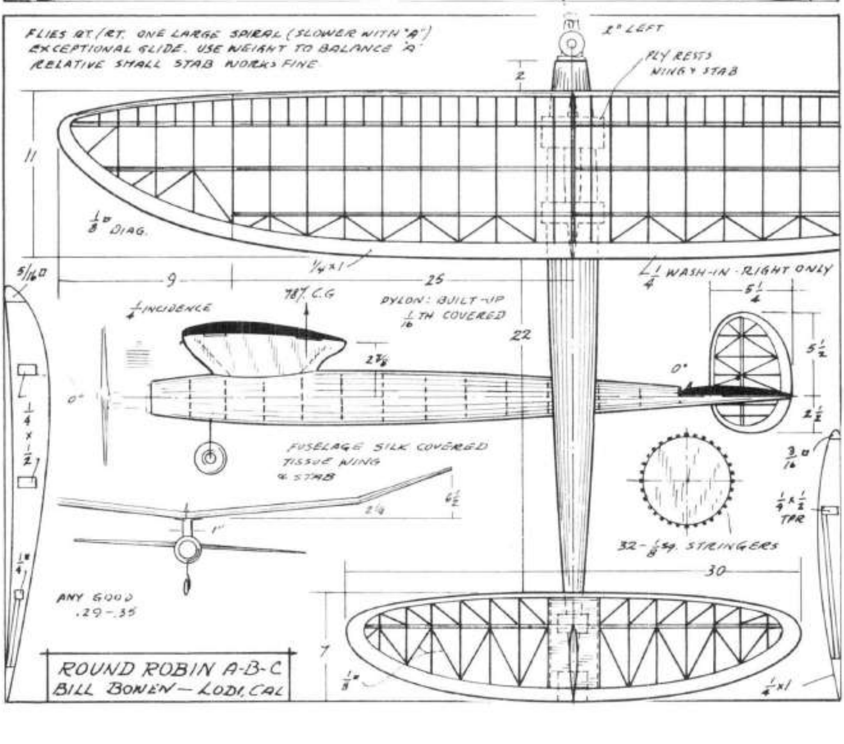

NOTE: USE 5 3/4 x 6 FIN IF ENGINE NOT TOO HOT
DOWEL 3/16 φ
64
TANK + TIMER IN NACELLE ?
C.G.
APPROX 34 OZ.
1/4 x 3/4 TOP & BOT.
1/8 TH SIDES
COVER WITH MED. WT SILKSPAN OR DOUBLE TISS.
FLIGHT: STEEP (80°) SLIGHT LEFT CLIMB GLIDE: LEFT
1/8 OR 1" φ EPOXY
DIMENSIONS FROM FULL SIZE PLANS
3/16 x 4 x 11
ANY GOOD .29-.35 MOUNT ON TATONE MT.
"C" RECORD TO NEW RULES BY ROBERT E. FRAZIER JAN. 3, 1965
1/4 PLY 2 φ
3/8 PYLON
3/16" FILL-IN
1/8 PLY x 1 x 4
B-C WITCH DOCTOR
JIM CLEM
SAND SPRINGS, OKLA
3/32 NO
3/16 x 3/4 → 7/16 TIP
1/8 x 3/8 + 1/4 TIP

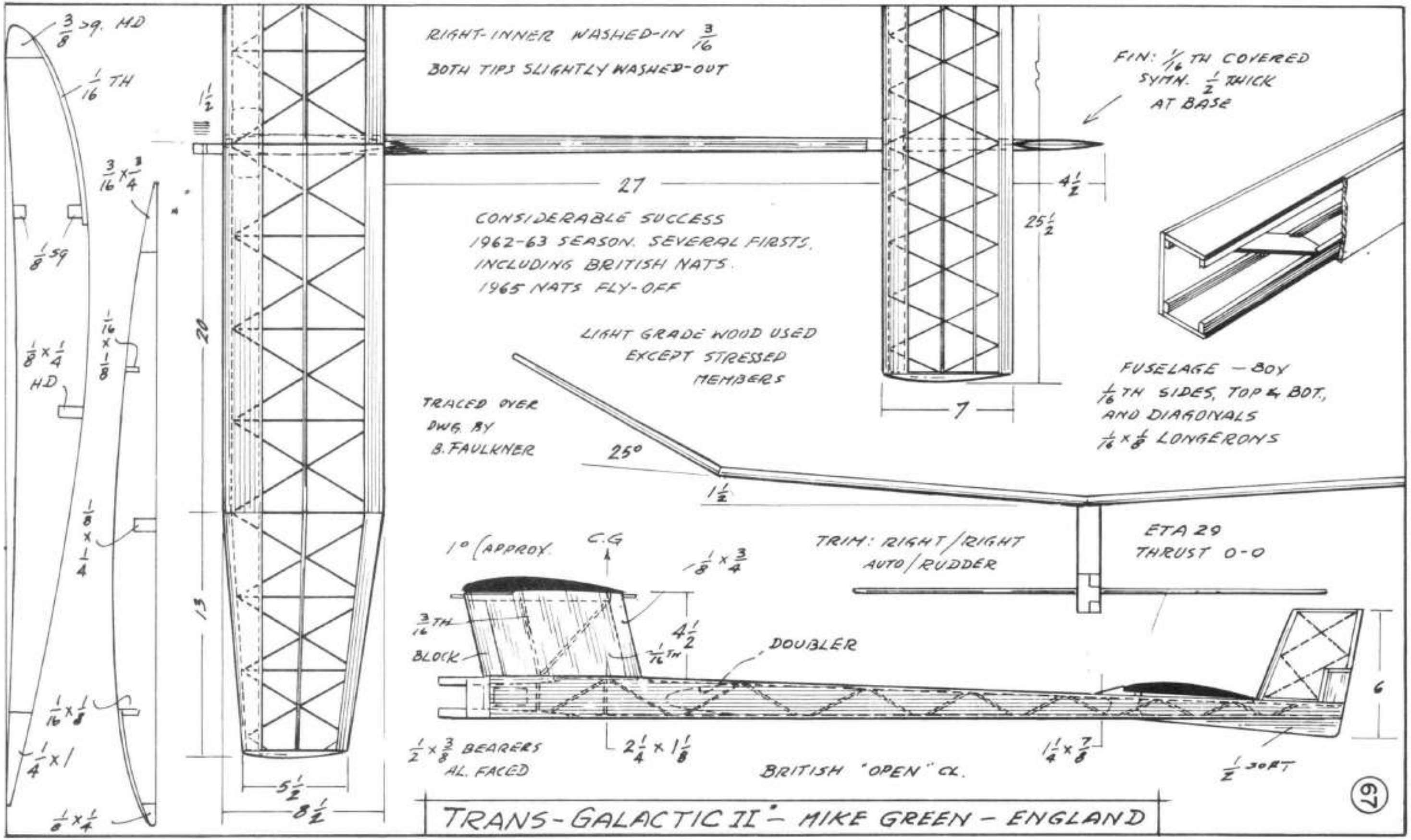

SHORF 4758 DF FOIL
STAB FOIL IS 9% THICK FLAT BOTTOMED.
3/8 SQ. L.E.
TAPER T.E. TO 1/8
1/4 x 1 T.E. STOCK (CARVE AFTER ASSEMBLY)
-TRIMMING-
MODEL IS TRIMMED TO CLIMB STRAIGHT AWAY AT ABOUT 80°. THE LIGHT FRAME PRECLUDES A SCREAMING CORKSCREW. TRIM GLIDE TURN WITH STAB TILT.
1 1/4 SPINNER
TEE DEE .15
7° DOWN-THRUST
1/4 A TICK-OFF
PYLON 1/8 CORE W/ 1/16 HARD SIDES
5/8 OUTLINE W/ 1/16 x 1/8 TRUSS
1/8 PLY SKID
FUSELAGE IS 1/4 ELLIPTICAL FORMERS ON 3/8 KEEL WITH 1/8 SQ. SPRUCE SIDE LONGERONS & 1/32 x 1/16 PLANKING.
1 3/4 STAB TILT
WEIGHT-17 OZ. READY TO FLY. LIGHT WEIGHT IS BASIC TO GOOD PERFORMANCE
D.J.L.
ELLIPTICAL FORMERS ARE DRAWN WITH A DROP COMPASS. SET COMPASS TO 1/2 MINOR AXIS & WITH POINT AT CENTER, TILT COMPASS 'TIL LEAD REACHES 1/2 MAJOR DIAMETER. ROTATE, ALLOWING MECHANISM TO SLIDE ALONG SHAFT. A PERFECT ELLIPSE WILL RESULT.
36 SPAN
1/8 SQ. SLICED RIBS (SEE FIZZLE)
1/8 SQ TRUSS
5/16 SQ. L.E.
1/8 TH SPARS-BEND AND TAPER TO FIT
3/16 x 3/8 T.E.
HI-BALL
D.J. LINDLEY INDIANA



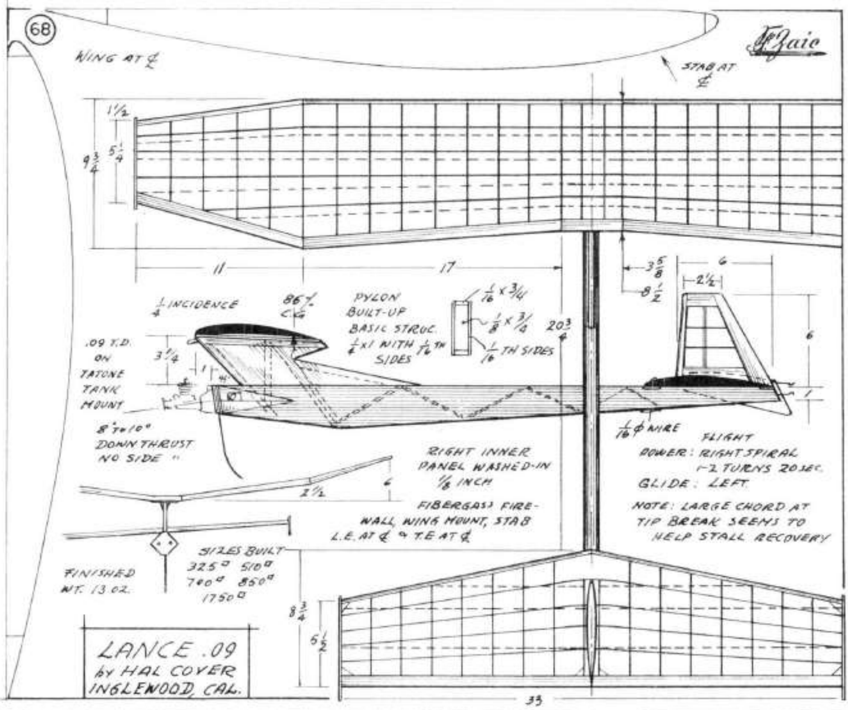
POWER
SUPER TIGRE 35
PROP: 10-4
JAP TISSUE COVERED
5 DOPES
F. Zaic
2" RIGHT
X RIBS FILLED-IN WITH 1/16TH SOFT FROM LE. TO T.E.
NO MORE THAN 1/32 INC.
2-1/4 LAMS
C.G
1/4 x 3/4 PINE
1/8TH TOP & BOT CROSS-GRAIN
1/8TH SIDES
1/8" LONGERONS
2-1/4 LAMS
KEYS
NOTE: THIS WILL BE MY THIRD YEAR OF FLYING DICK WERNER'S B-C "BEAN BOGAN, AND HAVE YET TO PLACE ANY LOWER THAN 2ND PLACE WITH IT.
DICK STATED THAT IT WOULD OUT GLIDE EVERY SHIP IN SIGHT. I HAVE FOUND THIS TO BE TRUE. WHEN MOST C OR B's HAVE 50 FT LEFT, THE FLYERS COUNT TIME IN SECONDS, BUT "BOGAN" COUNTS IT IN MINUTES.
R. FEAZEL
CHANGED TO 5° DOWN
1/16 BASS x 1 1/2 x 7 TIP PLATE
AIRFOIL OUTLINE
STAB 7% CLARK Y
1/16 x 1/4 CAP STRIPS TO 'A'
1/16 x 3/16 TO TIPS
2ND-1964 NATS-OPEN 'C'
32:00-BY RALPH FEAZEL, SHREVPORT, LA.
"BEAN BOGAN" 865—DICK WARNER
1/16TH SOFT FILL-IN ALL RIBS
RIBS SLICED FROM 1/8TH x 3/16
FROM MAY 1959 "FLYING MODELS"
65


66
3 LAMS - 1/8 x 1/2
1/8 x 1/2
JOHNSON CS .35
TATONE MT
18
20 1/2
WASH-OUT BOTH TIPS 1/4
1/16 PLY WING JUNCTION BRACES
WT. 28 oz.
WASH-IN INNER RT. 1/4"
WING 700 sq.in
STAB 270 "
30 1/4
1/32 WEB
FIBERGLASS TO DBLR
1/16 TH PLY DBLR
1/4 PLY
JONSON CS-35 WITH 10 x 4
3/8 TH PYLON
TOP & BOT. & FORMS. 1/8 TH
SIDES 3/16 TH
COR. 3/16 SQ
- RESTS -
37
FROM FEB. 1965 "AIRFOIL"
BIG 'D' CL C F/F
By DAVE KELLY
CHIPPAWA ONT.
1/16 TH x 2
1/16 WEB
1/8 x 1/4 SPR.
1/8 TH
8 LAMS - 1/8 x 1/4
1/4 x 1 CENTER
8 LAMS - 1/8 x 1/4 TIPS

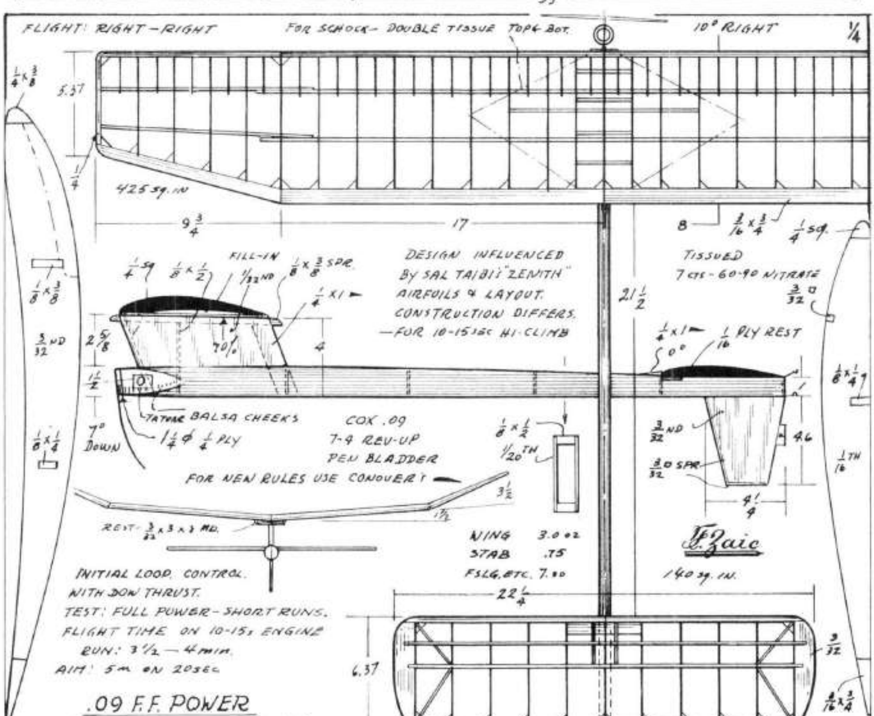

FLIES RT./RT. ONE LARGE SPIRAL (SLOWER WITH "A")
EXCEPTIONAL GLIDE. USE WEIGHT TO BALANCE 'A'
RELATIVE SMALL STAB WORKS FINE
2° LEFT
PLY RESTS WING & STAB
11
1/8" DIAG.
1/4 x 1
9
25
1/4 WASH-IN - RIGHT ONLY
1/4 INCIDENCE
78% C.G
PYLON: BUILT-UP 1/16 TH COVERED
22
FUSELAGE SILK COVERED
TISSUE WING & STAB
32 - 1/8 sq. STRINGERS
30
ANY GOOD .29 - .35
ROUND ROBIN A-B-C
BILL BOWEN — LODI, CAL



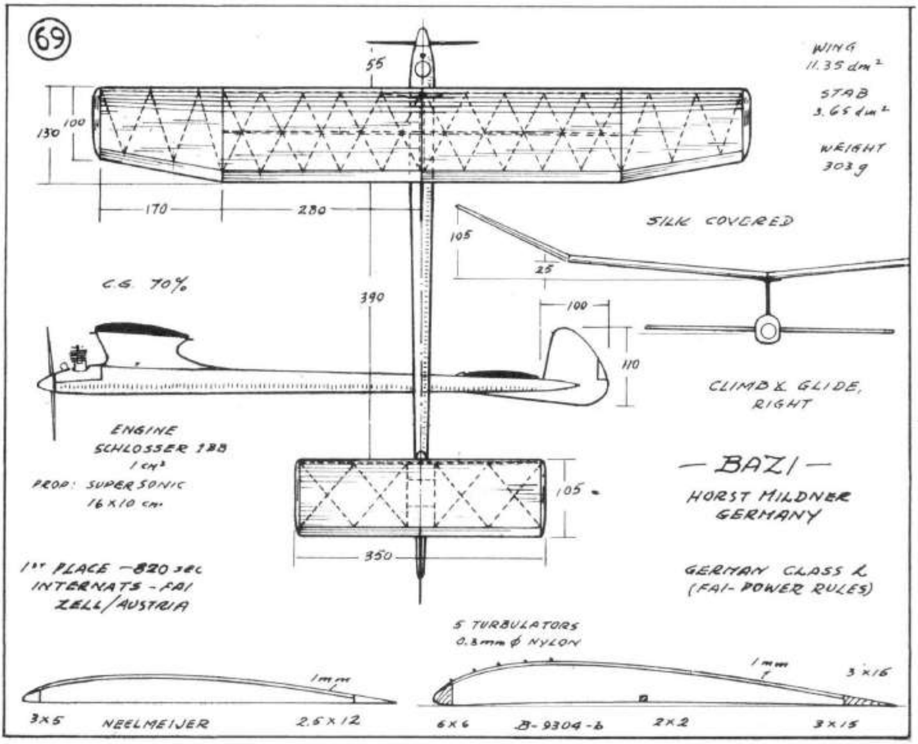
RIGHT-INNER WASHED-IN 3/16
BOTH TIPS SLIGHTLY WASHED-OUT
FIN: 1/16 TH COVERED SYMM. 1/2 THICK AT BASE
27
4 1/2
25 1/2
CONSIDERABLE SUCCESS 1962-63 SEASON. SEVERAL FIRSTS, INCLUDING BRITISH NATS. 1965 NATS FLY-OFF
LIGHT GRADE WOOD USED EXCEPT STRESSED MEMBERS
7
FUSELAGE — BOX 1/16 TH SIDES, TOP & BOT., AND DIAGONALS 1/16 x 1/8 LONGERONS
TRACED OVER DWG. BY B. FAULKNER
25°
1 1/2
3/8 SQ. HD
1/16 TH
3/16 x 3/4
1/8 SQ
1/8 x 1/4 HD
1/16 x 1/8
1/8 x 1/4
1/16 x 1/8
1/4 x 1
1/8 x 1/4
20
13
5 1/2
8 1/2
1° (APPROX.
C.G
1/8 x 3/4
TRIM: RIGHT/RIGHT AUTO/RUDDER
ETA 29 THRUST 0-0
3/16 TH BLOCK
4 1/2
1/16 TH
DOUBLER
6
1/2 x 3/8 BEARERS AL. FACED
2 1/4 x 1 1/8
1 1/4 x 7/8
1/2 SOFT
BRITISH "OPEN" CL.
TRANS-GALACTIC II — MIKE GREEN — ENGLAND



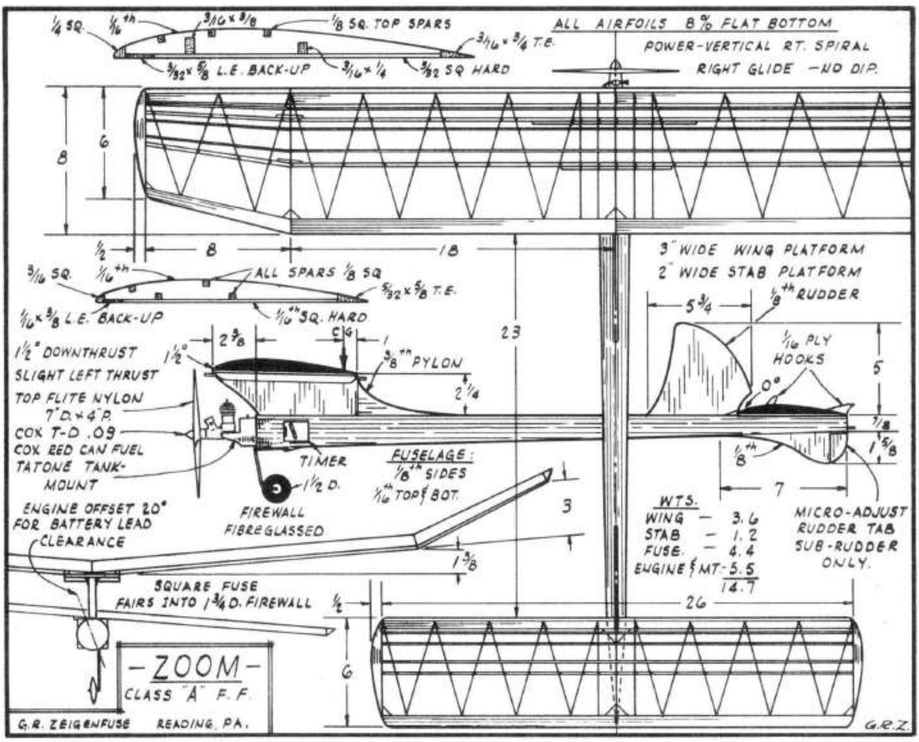
68
WING AT ℄
STAB AT ℄
F. Zaic
1 1/2
9 3/4
5 1/4
11
17
3 5/8
8 1/2
6
2 1/2
1/4 INCIDENCE
86% C.G.
PYLON BUILT-UP BASIC STRUC. 1/4 x 1 WITH 1/16 TH SIDES
1/16 x 3/4
1/8 x 3/4
1/16 TH SIDES
20 3/4
.09 T.D. ON TATONE TANK MOUNT
3 1/4
8° TO 10° DOWN THRUST NO SIDE "
1/16 ϕ WIRE
FLIGHT POWER: RIGHT SPIRAL 1-2 TURNS 20 SEC.
GLIDE: LEFT
RIGHT INNER PANEL WASHED-IN 1/8 INCH
2 1/2
FIBERGASS FIRE-WALL, WING MOUNT, STAB L.E. AT ℄ & T.E. AT ℄
NOTE: LARGE CHORD AT TIP BREAK SEEMS TO HELP STALL RECOVERY
SIZES BUILT 325 □ 510 □ 740 □ 850 □ 1750 □
FINISHED WT. 13 OZ.
8 3/4
6 1/2
33
LANCE .09
by HAL COVER
INGLEWOOD, CAL.



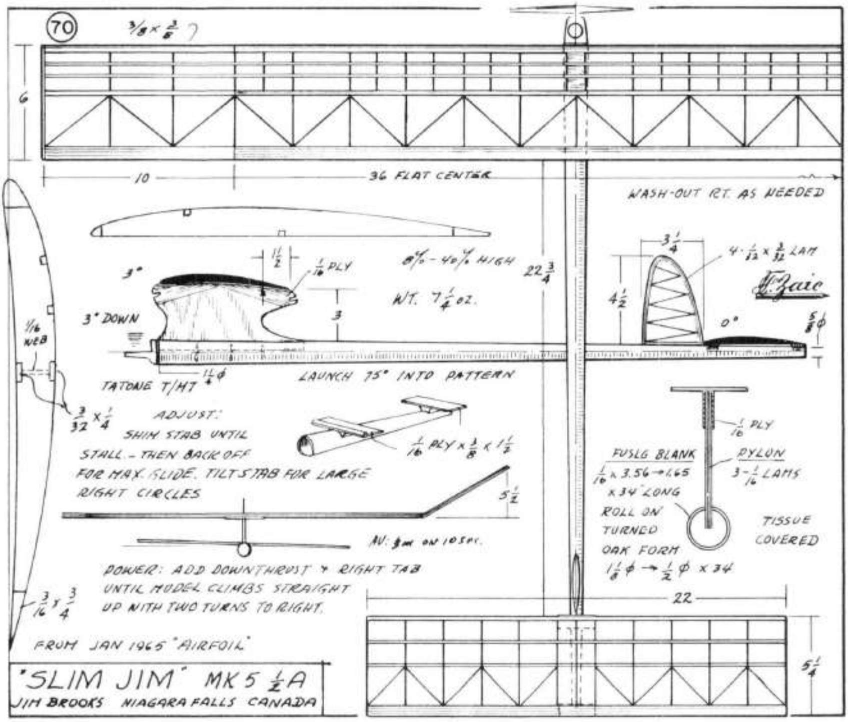
FLIGHT: RIGHT-RIGHT
FOR SCHOCK - DOUBLE TISSUE TOP & BOT.
10° RIGHT
1/4
1/4 x 3/8
5.37
1/4
425 sq. IN
9 3/4
17
8
3/16 x 3/4
1/4 sq.
1/4 sq
1/8 x 1/2
FILL-IN
1/32 ND
1/8 x 3/8 SPR.
1/4 x 1
DESIGN INFLUENCED BY SAL TAIBI'S "ZENITH" AIRFOILS & LAYOUT. CONSTRUCTION DIFFERS. —FOR 10-15 SEC HI-CLIMB
TISSUED 7 COTS - 60-90 NITRATE
3/32 □
21 1/2
1/8 x 3/8
3/32 ND
2 5/8
70%
4
1/4 x 1
1/16 PLY REST
0°
1/2
TATONE BALSA CHEEKS
7° DOWN
1 1/4 ϕ 1/4 PLY
COX .09 7-4 REV-UP PEN BLADDER
1/8 x 1/2
1/20 TH
3/32 ND
3/32 SPR.
4.6
1/8 x 1/4
1/16 TH
4 1/4
FOR NEW RULES USE CONOVER'S
3 1/2
1 1/2
REST - 3/32 x 3 x 3 PLY.
WING 3.0 OZ
STAB .75
FSLG, ETC. 7.00
F. Zaic
140 sq. IN.
INITIAL LOOP, CONTROL WITH DOW THRUST.
TEST: FULL POWER - SHORT RUNS.
FLIGHT TIME ON 10-15s ENGINE RUN: 3 1/2 - 4 min.
AIM: 5 m ON 20 SEC
22 1/4
6.37
3/32
1/16 x 3/4
.09 F.F. POWER
ED TURNER - FAIRBURG, NEBR.



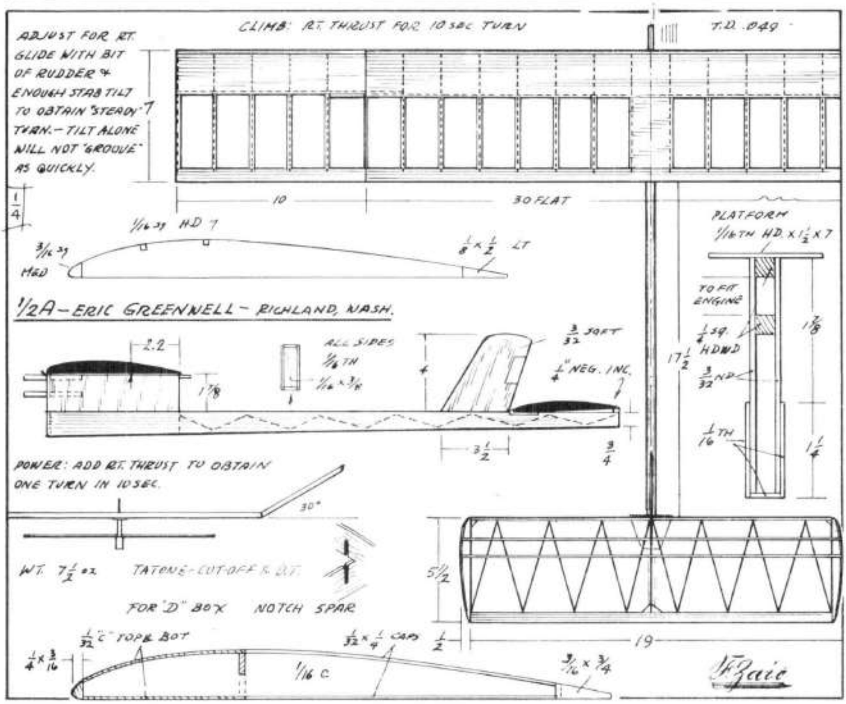
69
WING 11.35 dm²
STAB 3.65 dm²
WEIGHT 303 g
55
100
130
170
280
SILK COVERED
105
25
C.G. 70%
390
100
110
CLIMB & GLIDE, RIGHT
ENGINE SCHLOSSER 188 1 cm³
PROP: SUPERSONIC 16 x 10 cm
105
— BAZI —
HORST MILDNER GERMANY
350
1ST PLACE — 820 sec INTERNATS - FAI ZELL/AUSTRIA
GERMAN CLASS 1 (FAI - POWER RULES)
5 TURBULATORS 0.8 mm ϕ NYLON
1 mm
1 mm
3 x 16
3x5
NEELMEIJER
2.6 x 12
6x6
B-9304-b
2x2
3x15



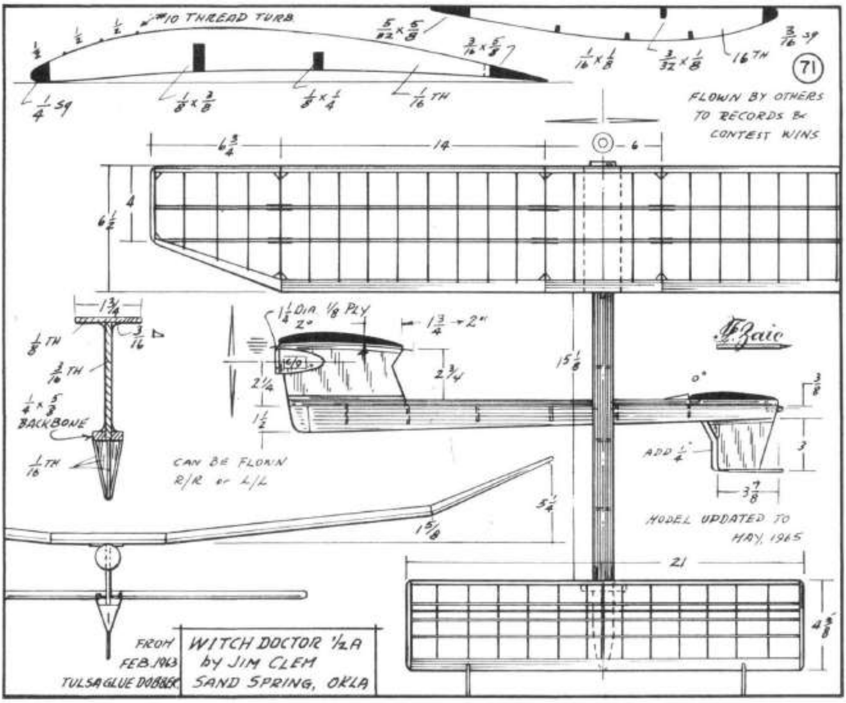
1/4 SQ.
1/16th
3/16 x 3/8
1/8 SQ. TOP SPARS
3/16 x 3/4 T.E.
3/32 x 5/8 L.E. BACK-UP
3/16 x 1/4
3/32 SQ HARD
ALL AIRFOILS 8% FLAT BOTTOM
POWER-VERTICAL RT. SPIRAL
RIGHT GLIDE — NO DIP.
8
6
1/2
8
18
3" WIDE WING PLATFORM
2" WIDE STAB PLATFORM
1/8th RUDDER
3/16 SQ.
1/16th
ALL SPARS 1/8 SQ
5/32 x 5/8 T.E.
1/16 x 3/8 L.E. BACK-UP
1/16th SQ. HARD
5 3/4
1 1/2° DOWNTHRUST
SLIGHT LEFT THRUST
1 1/2°
2 3/8
CG
23
3/8th PYLON
1/16 PLY HOOKS
TOP FLITE NYLON 7" D. x 4" P.
2 1/4
0°
5
COX T-D .09
COX RED CAN FUEL
TATONE TANK-MOUNT
TIMER
FUSELAGE: 1/8th SIDES 1/16th TOP & BOT.
1/2 D.
7/8
1/8th
1 5/8
7
ENGINE OFFSET 20° FOR BATTERY LEAD CLEARANCE
FIREWALL FIBREGLASSED
3
WTS.
WING — 3.6
STAB — 1.2
FUSE. — 4.4
ENGINE & MT - 5.5
14.7
MICRO-ADJUST RUDDER TAB SUB-RUDDER ONLY.
1 3/8
SQUARE FUSE FAIRS INTO 1 3/4 D. FIREWALL
1/2
26
— ZOOM —
CLASS "A" F.F.
6
G.R. ZEIGENFUSE READING, PA.
G.R.Z.



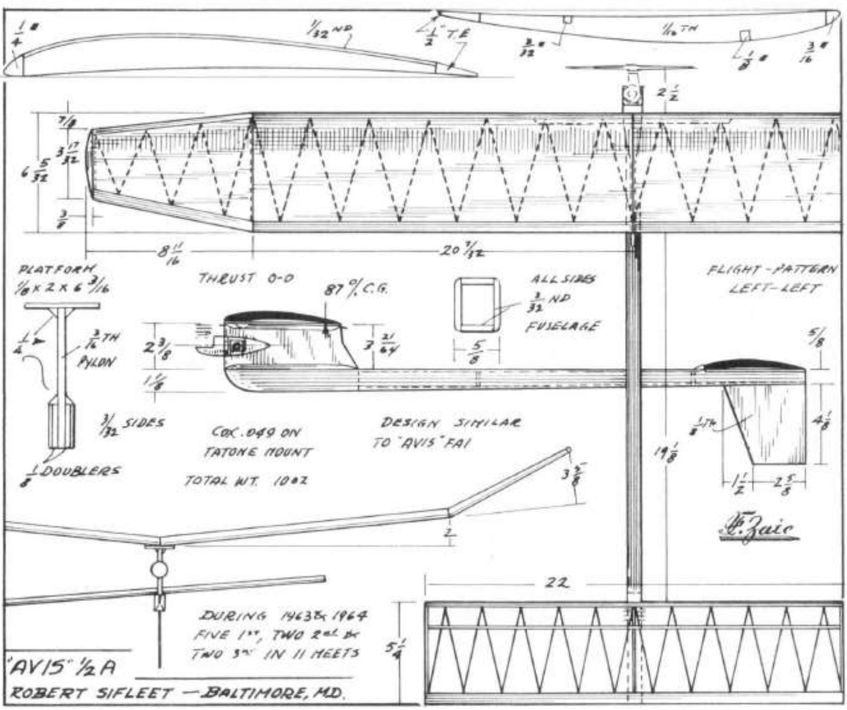
70
3/8 × 3/8
6
10
36 FLAT CENTER
WASH-OUT RT. AS NEEDED
1 1/2
1/16 PLY
8% - 40% HIGH
22 3/4
3 1/4
4 - 1/32 × 3/32 LAM
3°
3
WT. 7 1/4 OZ.
4 1/2
3° DOWN
0°
5/8 φ
1/16 WEB
TATONE T/HT
1 1/4 φ
LAUNCH 75° INTO PATTERN
3/32 × 1/4
ADJUST:
SHIM STAB UNTIL
STALL. - THEN BACK OFF
FOR MAX. GLIDE. TILT STAB FOR LARGE
RIGHT CIRCLES
1/16 PLY × 3/8 × 1 1/2
1/16 PLY
FUSLG BLANK
1/16 × 3.56 → 1.65
× 34" LONG
ROLL ON
TURNED
OAK FORM
1 1/8 φ → 1/2 φ × 34
PYLON
3 - 1/16 LAMS
TISSUE
COVERED
5 1/2
AV: 3m ON 10 SEC.
POWER: ADD DOWNTHRUST & RIGHT TAB
UNTIL MODEL CLIMBS STRAIGHT
UP WITH TWO TURNS TO RIGHT.
3/16 × 3/4
22
FROM JAN 1965 "AIRFOIL"
5 1/4
"SLIM JIM" MK 5 1/2 A
JIM BROOKS NIAGARA FALLS CANADA



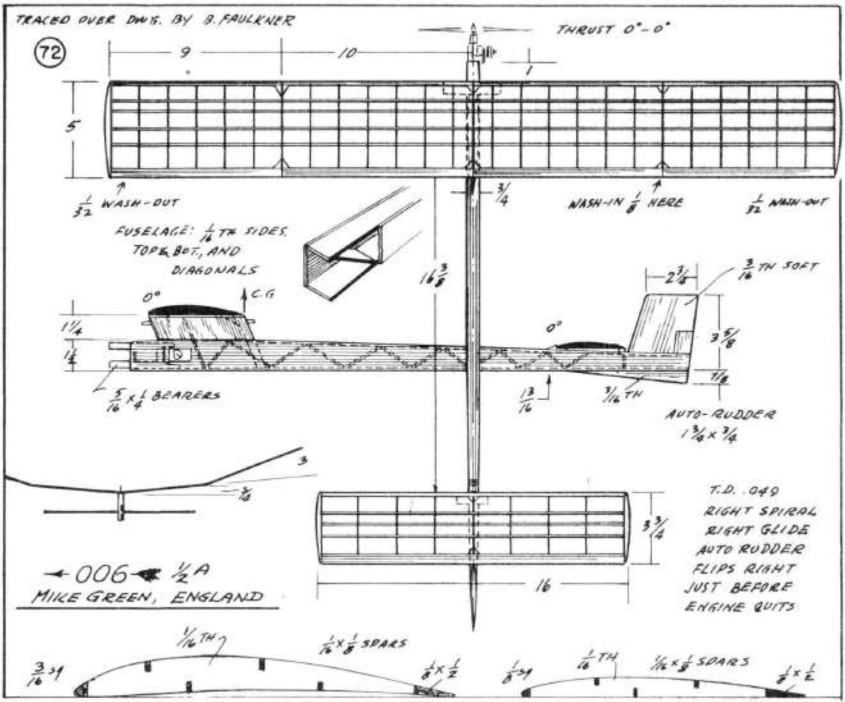
ADJUST FOR RT.
GLIDE WITH BIT
OF RUDDER &
ENOUGH STAB TILT
TO OBTAIN "STEADY"
TURN. - TILT ALONE
WILL NOT "GROOVE"
AS QUICKLY.
CLIMB: RT. THRUST FOR 10 SEC TURN
T.D. .049
7
1/4
10
30 FLAT
PLATFORM
1/16TH HD. × 1 1/2 × 7
1/16 SQ HD
3/16 SQ MED
1/8 × 1/2 LT
TO FIT ENGINE
1/2A - ERIC GREENNELL - RICHLAND, WASH.
2.2
ALL SIDES
1/16 TH
1/16 × 3/8
4
3/32 SOFT
1/4" NEG. INC.
1/4 SQ. HDWD
17 1/2
1 7/8
3/32 WD
1 7/8
3 1/2
3/4
1/16 TH
1 1/4
POWER: ADD RT. THRUST TO OBTAIN
ONE TURN IN 10 SEC.
30°
WT. 7 1/2 OZ
TATONE - CUT-OFF & D.T.
5 1/2
FOR "D" BOX NOTCH SPAR
1/32 "C" TOP & BOT
1/32 × 1/4 CAPS
1/2
19
1/4 × 3/16
1/16 C
3/16 × 3/4



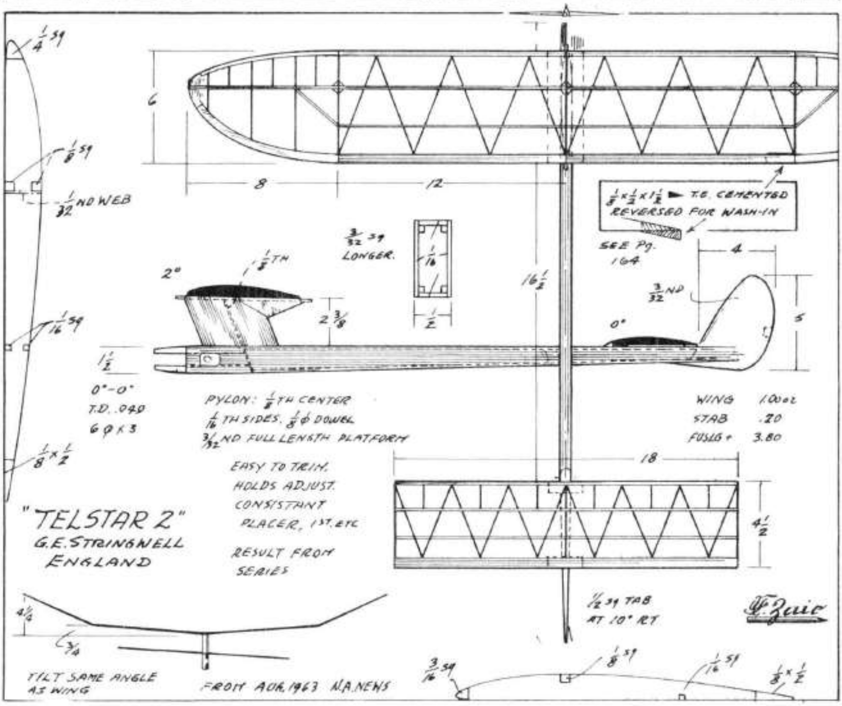
71
#10 THREAD TURB.
FLOWN BY OTHERS TO RECORDS & CONTEST WINS
CAN BE FLOWN R/R or L/L
MODEL UPDATED TO MAY, 1965
BACKBONE
ADD 1/4"
F. Zaic
FROM FEB. 1963 TULSA GLUE DOBBER
WITCH DOCTOR 1/2 A
by JIM CLEM
SAND SPRING, OKLA



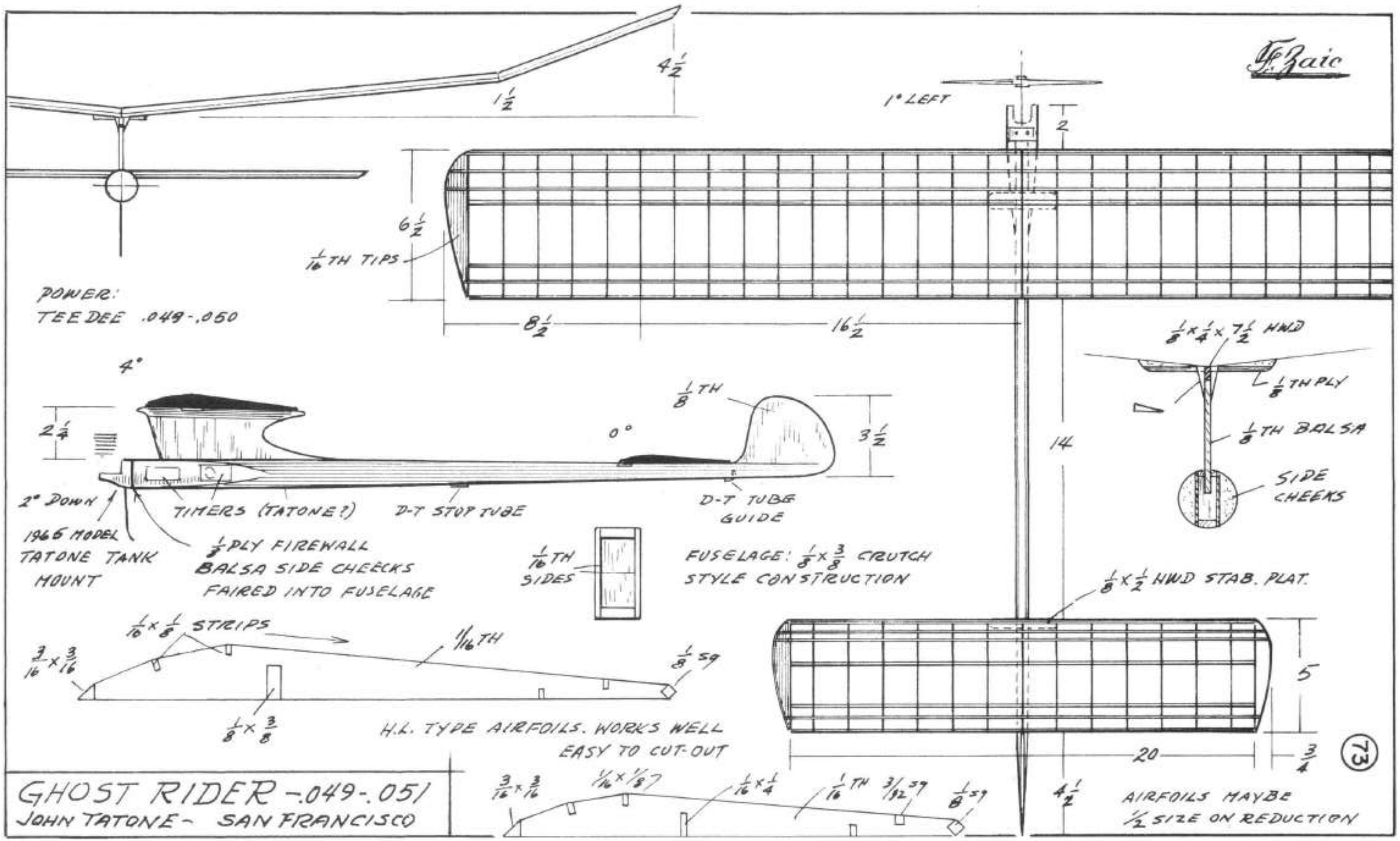
PLATFORM 1/16 x 2 x 6 3/16
PYLON
3/32 SIDES
1/8 DOUBLERS
THRUST 0-0
87 % C.G.
COX .049 ON TATONE MOUNT
TOTAL WT. 1 OZ
ALL SIDES 3/32 ND FUSELAGE
DESIGN SIMILAR TO "AVIS" FAI
FLIGHT-PATTERN LEFT-LEFT
F. Zaic
DURING 1963 & 1964 FIVE 1ST, TWO 2ND & TWO 3RD IN 11 MEETS
"AVIS" 1/2 A
ROBERT SIFLEET — BALTIMORE, MD.

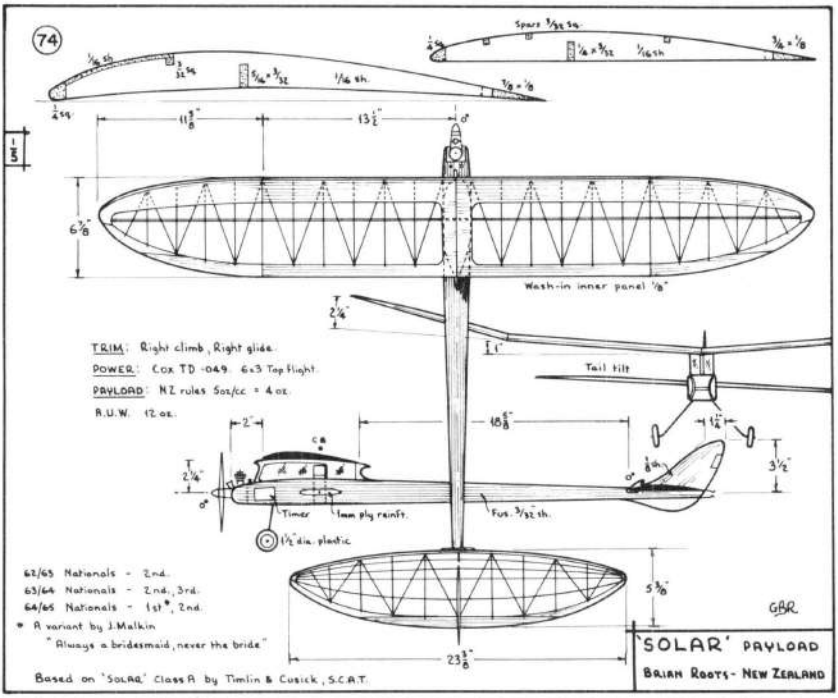


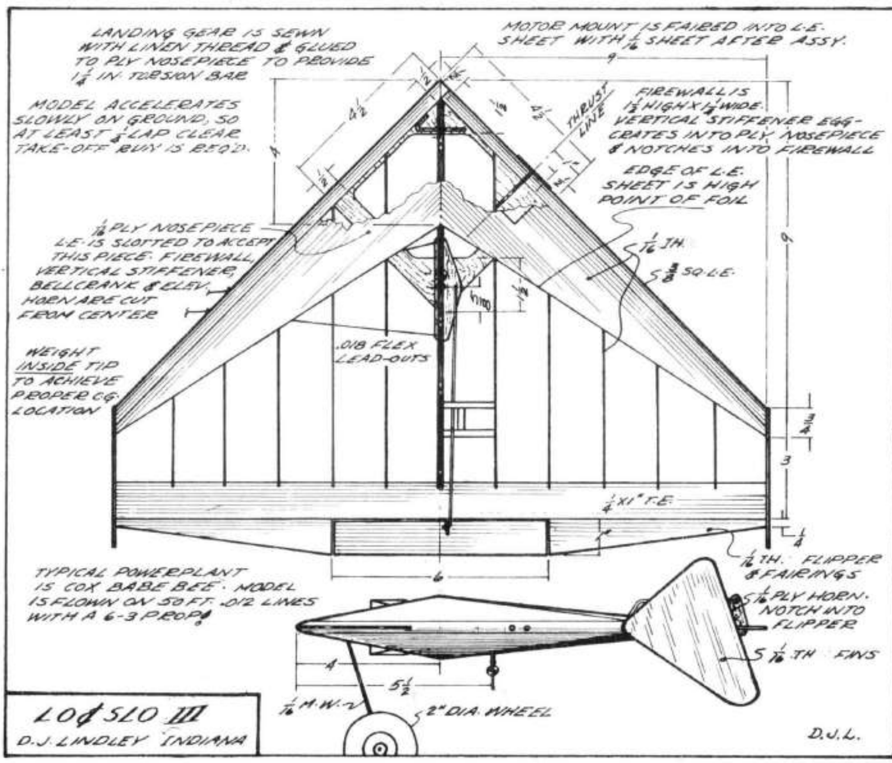
TRACED OVER DWG. BY B. FAULKNER
72
THRUST 0°-0°
9
10
1
5
1/32 WASH-OUT
3/4
WASH-IN 1/8 HERE
1/32 WASH-OUT
FUSELAGE: 1/16 TH SIDES, TOP & BOT., AND DIAGONALS
16 3/8
2 3/4
3/16 TH SOFT
0°
C.G
1 1/4
1/2
0°
3 5/8
5/16 x 1/4 BEARERS
13/16
3/16 TH
1/8
AUTO-RUDDER 1 3/4 x 3/4
3
3/4
T.D. .049
RIGHT SPIRAL
RIGHT GLIDE
AUTO RUDDER
FLIPS RIGHT
JUST BEFORE
ENGINE QUITS
3 3/4
16
006 1/2 A
MIKE GREEN, ENGLAND
1/16 TH
1/16 x 1/8 SPARS
3/16 sq
1/8 x 1/2
1/8 sq
1/16 TH
1/16 x 1/8 SPARS
1/8 x 1/2

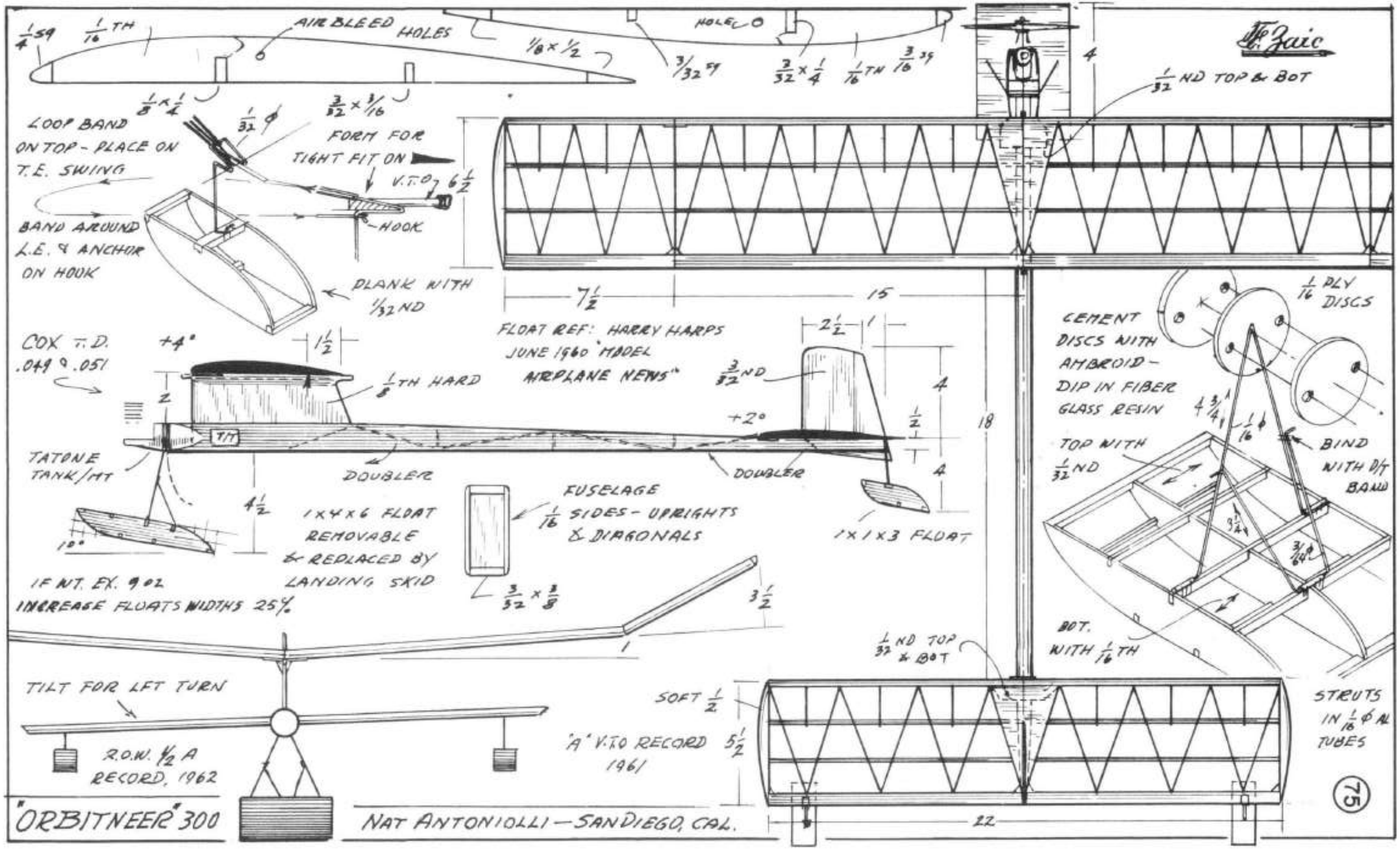


1/4 sq
6
1/8 sq
1/32 NO WEB
8
12
1/8 x 1/2 x 1 1/2 T.E. CEMENTED REVERSED FOR WASH-IN
SEE Pg. 164
3/32 sq LONGER.
1/16
1/2
2°
1/8 TH
16 1/2
4
3/32 NO
2 3/8
1/16 sq
0°
5
1 1/2
0°-0°
T.D. .049
6 φ x 3
PYLON: 1/8 TH CENTER
1/16 TH SIDES, 1/8 φ DOWEL
3/32 NO FULL LENGTH PLATFORM
WING 1.00 oz
STAB .20
FUSLG + 3.80
18
1/8 x 1/2
EASY TO TRIM, HOLDS ADJUST. CONSISTANT PLACER, 1ST ETC
RESULT FROM SERIES
4 1/2
"TELSTAR 2"
G.E. STRINGWELL
ENGLAND
4 1/4
3/4
1/2 sq TAB AT 10° RT.
F. Zaic
TILT SAME ANGLE AS WING
FROM AUG. 1963 M.A. NEWS
3/16 sq
1/8 sq
1/16 sq
1/8 x 1/2

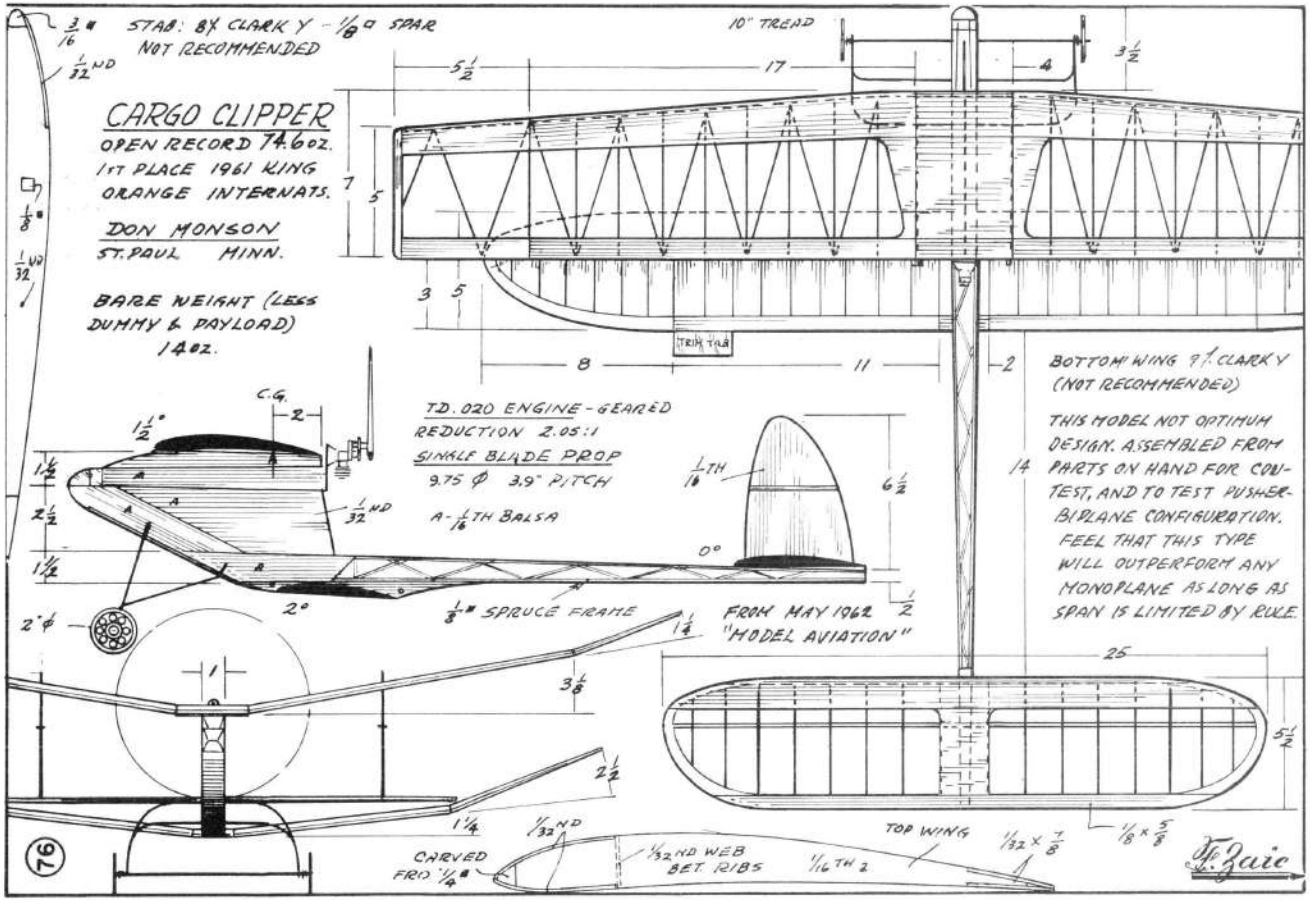

GHOST RIDER -.049-.051
JOHN TATONE - SAN FRANCISCO
73
Zaic
POWER:
TEEDEE .049-.050
1° LEFT
2
4 1/2
1 1/2
6 1/2
1/16 TH TIPS
8 1/2
16 1/2
14
4°
2 1/4
0°
1/8 TH
3 1/2
2° DOWN
1966 MODEL
TATONE TANK
MOUNT
TIMERS (TATONE?)
D-T STOP TUBE
D-T TUBE
GUIDE
1/8 PLY FIREWALL
BALSA SIDE CHEECKS
FAIRED INTO FUSELAGE
1/16 TH
SIDES
FUSELAGE: 1/8 x 3/8 CRUTCH
STYLE CONSTRUCTION
1/8 x 1/4 x 7 1/2 HWD
1/8 TH PLY
1/8 TH BALSA
SIDE
CHEEKS
1/8 x 1/2 HWD STAB. PLAT.
1/16 x 1/8 STRIPS
3/16 x 3/16
1/16 TH
1/8 SQ
1/8 x 3/8
H.L. TYPE AIRFOILS. WORKS WELL
EASY TO CUT-OUT
5
20
3/4
4 1/2
3/16 x 3/16
1/16 x 1/8
1/16 x 1/4
1/16 TH
3/32 SQ
1/8 SQ
AIRFOILS MAYBE
1/2 SIZE ON REDUCTION


74
Spars 3/32 sq.
Wash-in inner panel 1/8"
Tail tilt
TRIM: Right climb, Right glide.
POWER: Cox TD ·049. 6x3 Top flight.
PAYLOAD: NZ rules 5oz/cc = 4 oz.
R.U.W. 12 oz.
Timer
1mm ply reinft.
Fus. 3/32 sh.
1½" dia. plastic
62/63 Nationals - 2nd.
63/64 Nationals - 2nd., 3rd.
64/65 Nationals - 1st*, 2nd.
* A variant by J. Malkin
"Always a bridesmaid, never the bride"
Based on 'SOLAR' Class A by Timlin & Cusick, S.C.A.T.
GBR
'SOLAR' PAYLOAD
BRIAN ROOTS - NEW ZEALAND

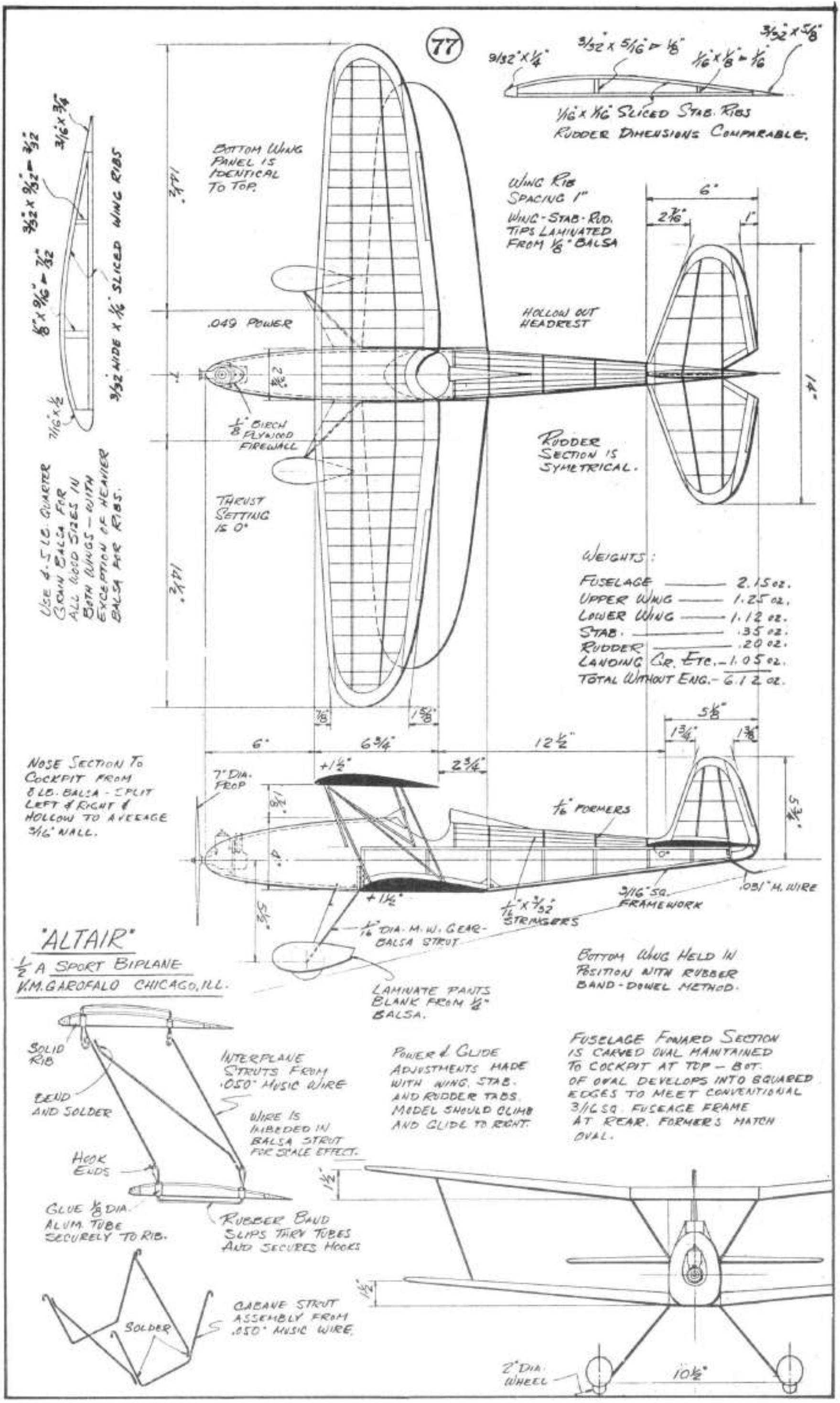

LANDING GEAR IS SEWN WITH LINEN THREAD & GLUED TO PLY NOSEPIECE TO PROVIDE 1¼ IN. TORSION BAR
MOTOR MOUNT IS FAIRED INTO L.E. SHEET WITH 1/16 SHEET AFTER ASSY.
MODEL ACCELERATES SLOWLY ON GROUND, SO AT LEAST ¼ LAP CLEAR TAKE-OFF RUN IS REQ'D.
THRUST LINE
FIREWALL IS 1½ HIGH X 1½ WIDE. VERTICAL STIFFENER EGG-CRATES INTO PLY NOSEPIECE & NOTCHES INTO FIREWALL
EDGE OF L.E. SHEET IS HIGH POINT OF FOIL
1/8 PLY NOSEPIECE L.E. IS SLOTTED TO ACCEPT THIS PIECE. FIREWALL, VERTICAL STIFFENER, BELLCRANK & ELEV. HORN ARE CUT FROM CENTER
1/16 TH.
3/8 SQ. L.E.
WEIGHT INSIDE TIP TO ACHIEVE PROPER C.G. LOCATION
.018 FLEX LEAD-OUTS
¼ X 1" T.E.
TYPICAL POWERPLANT IS COX BABE BEE. MODEL IS FLOWN ON 50 FT. .012 LINES WITH A 6-3 PROP.
1/16 TH. FLIPPER & FAIRINGS
1/16 PLY HORN. NOTCH INTO FLIPPER
1/16 TH FINS
1/16 M.W.
2" DIA. WHEEL
LO & SLO III
D.J. LINDLEY INDIANA
D.J.L.



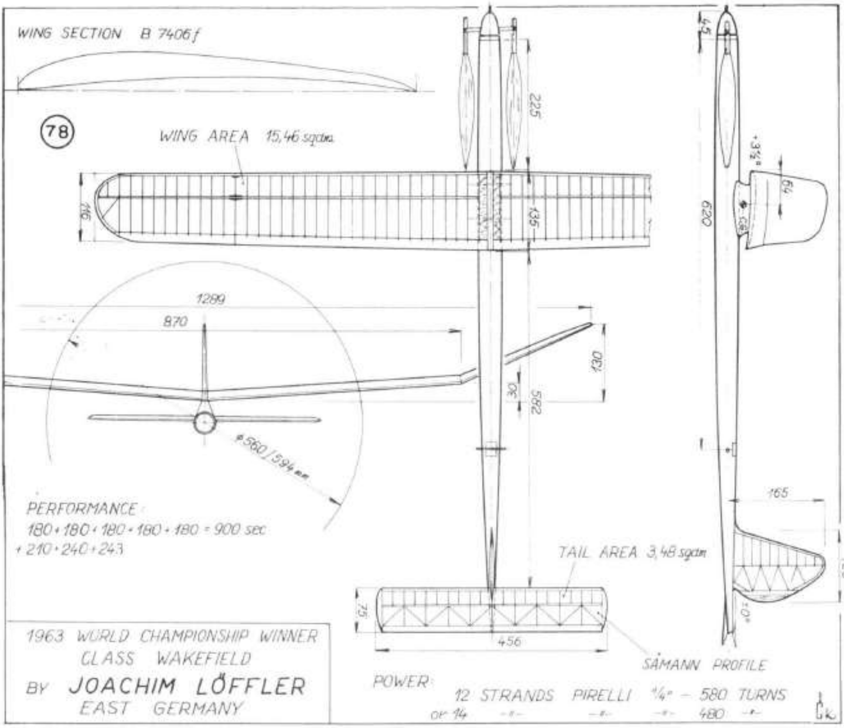
AIR BLEED HOLES
1/4 SQ
1/16 TH
1/8 × 1/2
HOLE O
3/32 SQ
3/32 × 1/4
1/16 TH
3/16 SQ
1/8 × 1/4
3/32 × 3/16
FORM FOR TIGHT FIT ON
LOOP BAND ON TOP - PLACE ON T.E. SWING
1/32 ϕ
V.T.O. 6 1/2
HOOK
BAND AROUND L.E. & ANCHOR ON HOOK
PLANK WITH 1/32 ND
1/32 ND TOP & BOT
4
7 1/2
15
18
COX T.D. .049 & .051
+4°
1 1/2
2
1/8 TH HARD
FLOAT REF: HARRY HARPS JUNE 1960 "MODEL AIRPLANE NEWS"
3/32 ND
2 1/2
1
+2°
1/2
TATONE TANK/MT
DOUBLER
DOUBLER
4 1/2
10°
1 × 4 × 6 FLOAT REMOVABLE & REPLACED BY LANDING SKID
FUSELAGE 1/16 SIDES - UPRIGHTS & DIAGONALS
3/32 × 3/8
1 × 1 × 3 FLOAT
IF WT. EX. 9 OZ INCREASE FLOATS WIDTHS 25%
3 1/2
1
CEMENT DISCS WITH AMBROID - DIP IN FIBER GLASS RESIN
1/16 PLY DISCS
4 3/4
1/16 ϕ
BIND WITH D/T BAND
TOP WITH 1/32 ND
3 1/4
3/64 ϕ
BOT. WITH 1/16 TH
1/32 ND TOP & BOT
SOFT 1/2
5 1/2
'A' V.T.O RECORD 1961
22
STRUTS IN 1/16 ϕ AL TUBES
TILT FOR LFT TURN
R.O.W. 1/2 A RECORD, 1962
"ORBITNEER" 300
NAT ANTONIOLLI — SAN DIEGO, CAL.
75

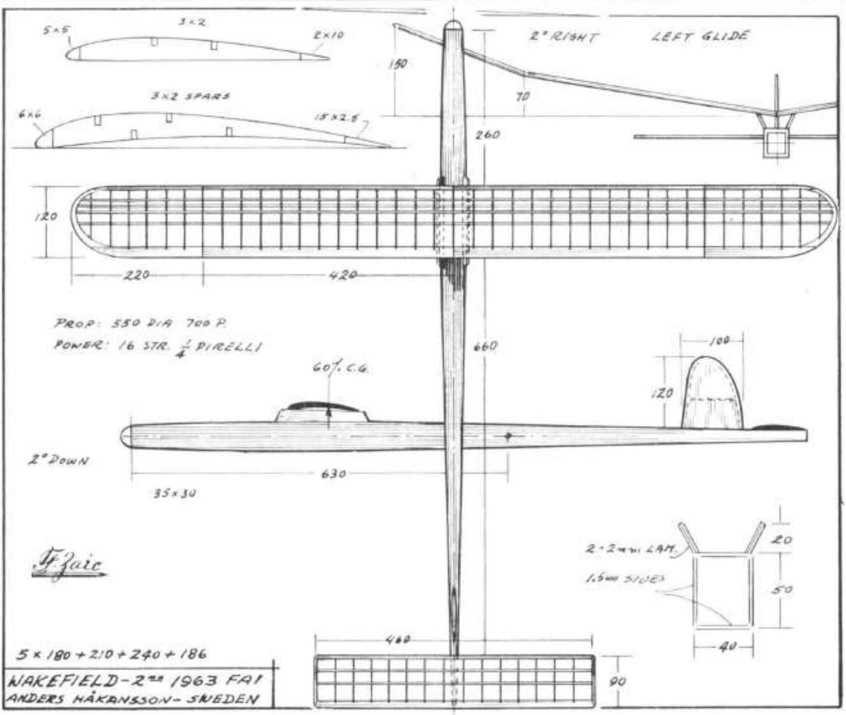


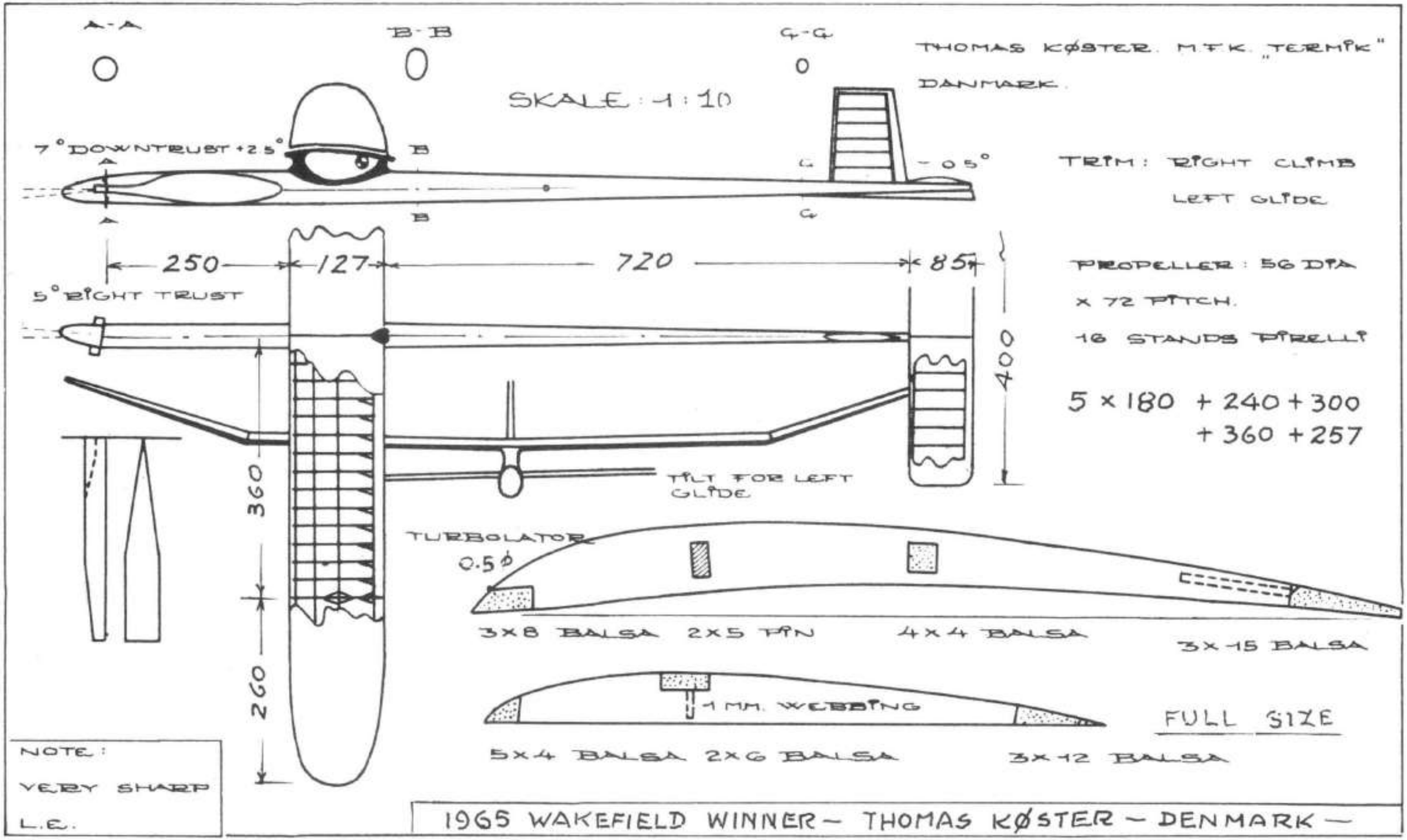
CARGO CLIPPER
OPEN RECORD 74.6 OZ.
1ST PLACE 1961 KING ORANGE INTERNATS.
DON MONSON
ST. PAUL MINN.
BARE WEIGHT (LESS DUMMY & PAYLOAD) 14 OZ.
STAB: 8% CLARK Y - 1/8 □ SPAR
NOT RECOMMENDED
10" TREAD
TRIM TAB
BOTTOM WING 9% CLARK Y
(NOT RECOMMENDED)
THIS MODEL NOT OPTIMUM DESIGN. ASSEMBLED FROM PARTS ON HAND FOR CONTEST, AND TO TEST PUSHER-BIPLANE CONFIGURATION. FEEL THAT THIS TYPE WILL OUTPERFORM ANY MONOPLANE AS LONG AS SPAN IS LIMITED BY RULE.
C.G.
T.D. .020 ENGINE - GEARED
REDUCTION 2.05:1
SINGLE BLADE PROP
9.75 Φ 3.9" PITCH
A - 1/16 TH BALSA
1/8 □ SPRUCE FRAME
FROM MAY 1962 "MODEL AVIATION"
TOP WING
CARVED FROM 1/4 □
1/32 ND WEB BET. RIBS
1/16 TH 2
1/32 × 7/8
1/8 × 5/8
76
F. Zaic

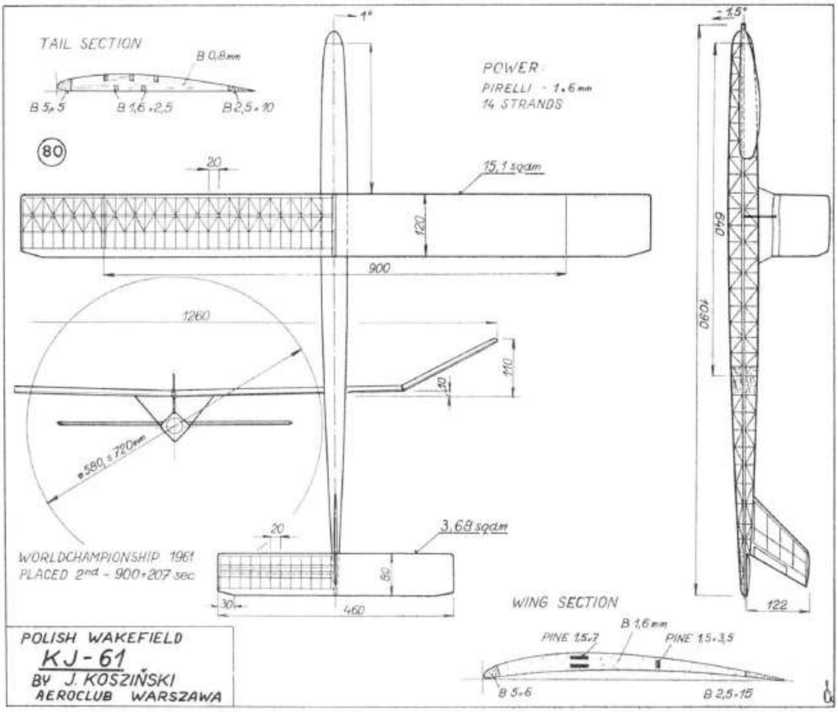


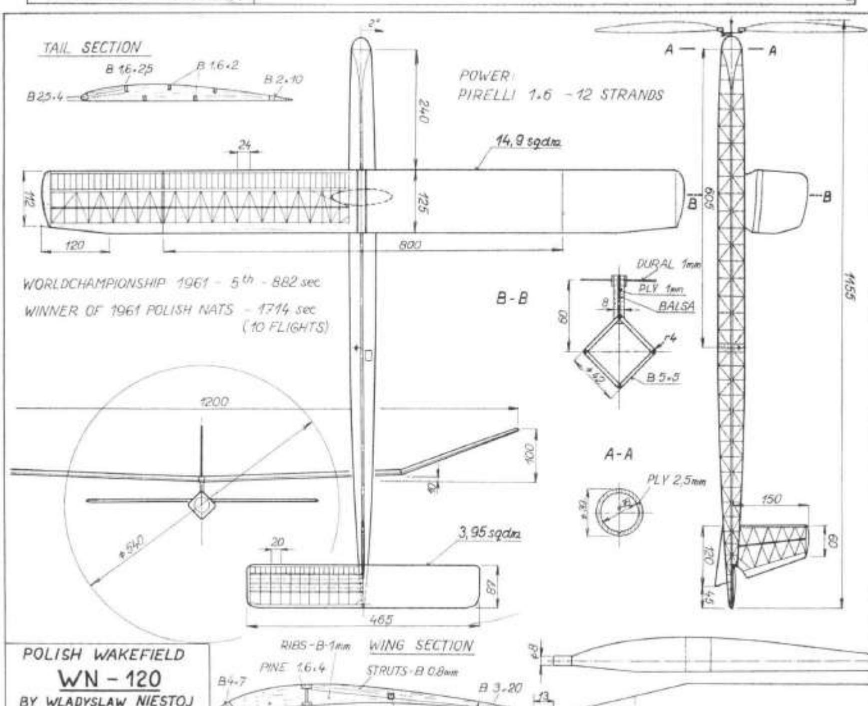
77
"ALTAIR"
1/2 A SPORT BIPLANE
V.M. GAROFALO CHICAGO, ILL.
BOTTOM WING PANEL IS IDENTICAL TO TOP.
WING RIB SPACING 1"
WING-STAB-RUD. TIPS LAMINATED FROM 1/8" BALSA
1/16" x 1/16" SLICED STAB. RIBS
RUDDER DIMENSIONS COMPARABLE.
3/32" WIDE x 1/16" SLICED WING RIBS
USE 4-5 LB. QUARTER GRAIN BALSA FOR ALL WOOD SIZES IN BOTH WINGS — WITH EXCEPTION OF HEAVIER BALSA FOR RIBS.
.049 POWER
1/8" BIRCH PLYWOOD FIREWALL
HOLLOW OUT HEADREST
RUDDER SECTION IS SYMETRICAL.
THRUST SETTING IS 0°
WEIGHTS:
FUSELAGE — 2.15 oz.
UPPER WING — 1.25 oz.
LOWER WING — 1.12 oz.
STAB. — .35 oz.
RUDDER — .20 oz.
LANDING GR. ETC. — 1.05 oz.
TOTAL WITHOUT ENG. — 6.12 oz.
NOSE SECTION TO COCKPIT FROM 8 LB. BALSA - SPLIT LEFT & RIGHT & HOLLOW TO AVERAGE 3/16" WALL.
7" DIA. PROP
1/16" FORMERS
3/16" SQ. FRAMEWORK
.031" M. WIRE
1/16" x 3/32" STRINGERS
1/16" DIA. M.W. GEAR-BALSA STRUT
LAMINATE PANTS BLANK FROM 1/2" BALSA.
BOTTOM WING HELD IN POSITION WITH RUBBER BAND-DOWEL METHOD.
SOLID RIB
BEND AND SOLDER
INTERPLANE STRUTS FROM .050" MUSIC WIRE
WIRE IS IMBEDED IN BALSA STRUT FOR SCALE EFFECT.
HOOK ENDS
GLUE 1/8 DIA. ALUM. TUBE SECURELY TO RIB.
RUBBER BAND SLIPS THRU TUBES AND SECURES HOOKS
SOLDER
CABANE STRUT ASSEMBLY FROM .050" MUSIC WIRE.
POWER & GLIDE ADJUSTMENTS MADE WITH WING, STAB. AND RUDDER TABS. MODEL SHOULD CLIMB AND GLIDE TO RIGHT.
FUSELAGE FORWARD SECTION IS CARVED OVAL MAINTAINED TO COCKPIT AT TOP — BOT. OF OVAL DEVELOPS INTO SQUARED EDGES TO MEET CONVENTIONAL 3/16 SQ. FUSELAGE FRAME AT REAR. FORMERS MATCH OVAL.
2" DIA. WHEEL
10 1/2"

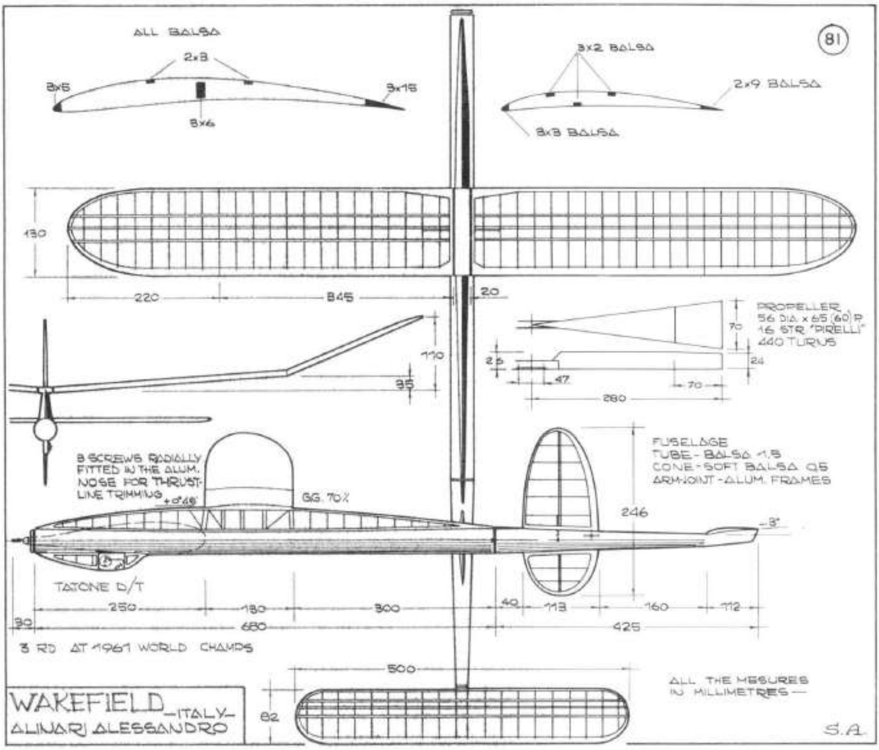

WING SECTION B 7406 f
78
WING AREA 15,46 sqdm
225
116
135
620
1289
870
130
30
582
ø 560 / 594 mm
PERFORMANCE
180 + 180 + 180 + 180 + 180 = 900 sec
+ 210 + 240 + 243
165
TAIL AREA 3,48 sqdm
125
75
456
SÄMANN PROFILE
1963 WORLD CHAMPIONSHIP WINNER
CLASS WAKEFIELD
BY JOACHIM LÖFFLER
EAST GERMANY
POWER
12 STRANDS PIRELLI 1/4" – 580 TURNS
OR 14 – 480


5×5
3×2
2×10
3×2 SPARS
6×6
15×2.5
150
2° RIGHT
LEFT GLIDE
70
260
120
220
420
PROP: 550 DIA 700 P.
POWER: 16 STR. 1/4 PIRELLI
660
60% C.G.
100
120
2° DOWN
630
35×30
2-2mm LAM.
1,5mm SIDES
20
50
40
460
90
5 × 180 + 210 + 240 + 186
WAKEFIELD-2nd 1963 FAI
ANDERS HÅKANSSON-SWEDEN

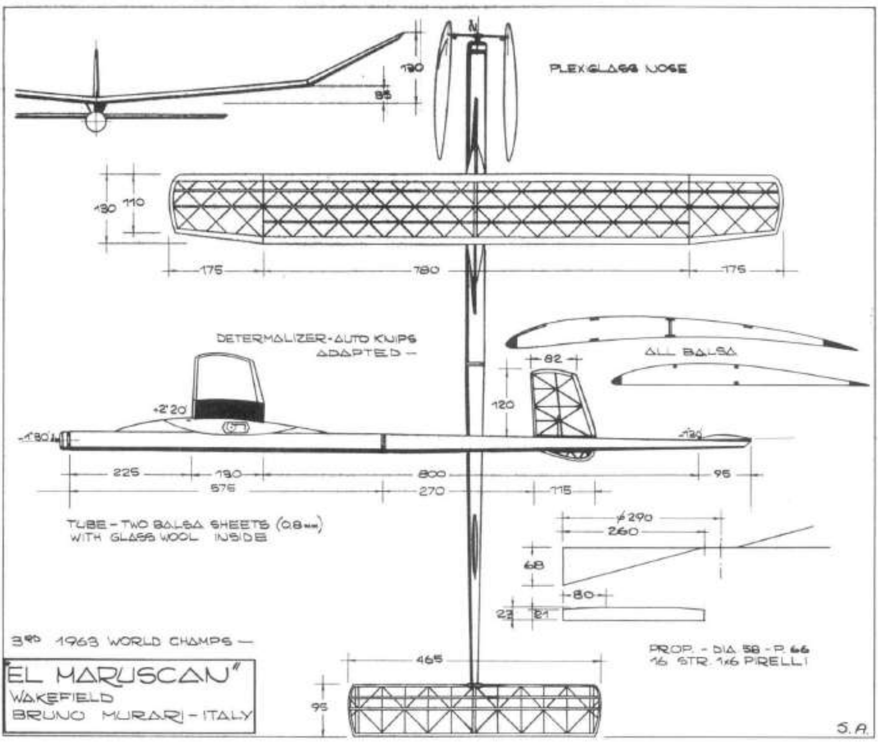

A-A
B-B
G-G
THOMAS KØSTER. M.F.K. „TERMIK"
DANMARK.
SKALE 1:10
7° DOWNTRUST +2.5°
A
B
G
-0.5°
TRIM: RIGHT CLIMB
LEFT GLIDE
250
127
720
85
5° RIGHT TRUST
PROPELLER: 56 DIA
x 72 PITCH.
16 STANDS PIRELLI
400
5 x 180 + 240 + 300
+ 360 + 257
360
TILT FOR LEFT
GLIDE
TURBOLATOR
0.5 ϕ
3x8 BALSA
2x5 PIN
4x4 BALSA
3x15 BALSA
260
1 MM. WEBBING
FULL SIZE
5x4 BALSA
2x6 BALSA
3x12 BALSA
NOTE:
VERY SHARP
L.E.
1965 WAKEFIELD WINNER – THOMAS KØSTER – DENMARK –


TAIL SECTION
B 0,8mm
B 5,5
B 1,6 × 2,5
B 2,5 × 10
80
POWER:
PIRELLI - 1 × 6 mm
14 STRANDS
1°
20
15,1 sqdm
120
900
1260
110
10
⌀580, s 720mm
640
1090
1,5°
20
3,68 sqdm
80
30
460
122
WORLDCHAMPIONSHIP 1961
PLACED 2nd - 900+207 sec
WING SECTION
B 1,6mm
PINE 1,5 × 7
PINE 1,5 × 3,5
B 5 × 6
B 2,5 × 15
POLISH WAKEFIELD
KJ-61
BY J. KOSZIŃSKI
AEROCLUB WARSZAWA

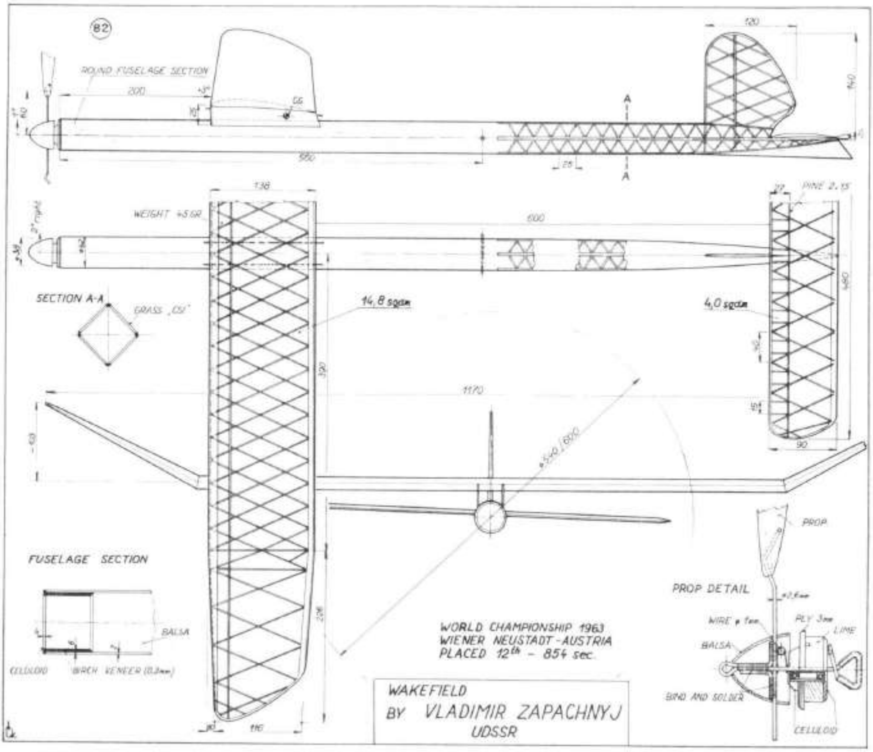

TAIL SECTION
B 1,6 × 25
B 1,6 × 2
B 2 × 10
B 2,5 × 4
2°
POWER:
PIRELLI 1 × 6 - 12 STRANDS
240
24
14,9 sqdm
112
125
120
800
B
B
605
1155
WORLDCHAMPIONSHIP 1961 - 5th - 882 sec
WINNER OF 1961 POLISH NATS - 1714 sec
(10 FLIGHTS)
B - B
DURAL 1mm
PLY 1mm
8
BALSA
60
r4
B 5 × 5
A
A
1200
100
10
A - A
PLY 2,5mm
150
60
120
45
⌀640
20
3,95 sqdm
87
465
POLISH WAKEFIELD
WN - 120
BY WLADYSLAW NIESTOJ
AEROCLUB WARSZAWA
RIBS - B - 1mm
WING SECTION
PINE 1,6 × 4
STRUTS - B 0,8mm
B 4 × 7
B 3 × 20
B 0,8mm
B 2,5 × 2,5
13

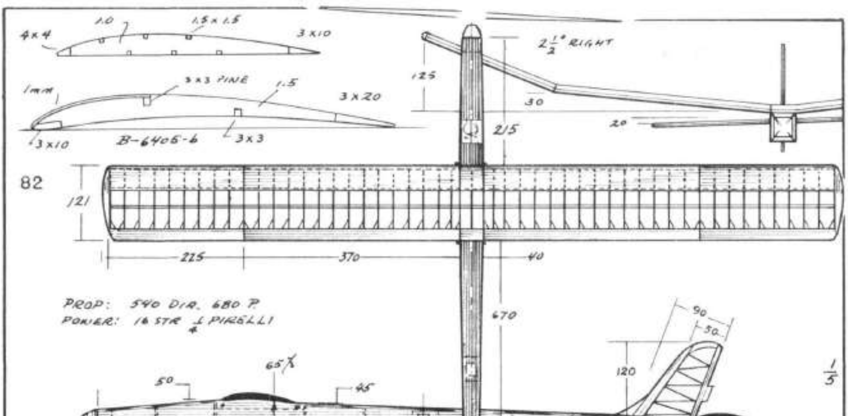


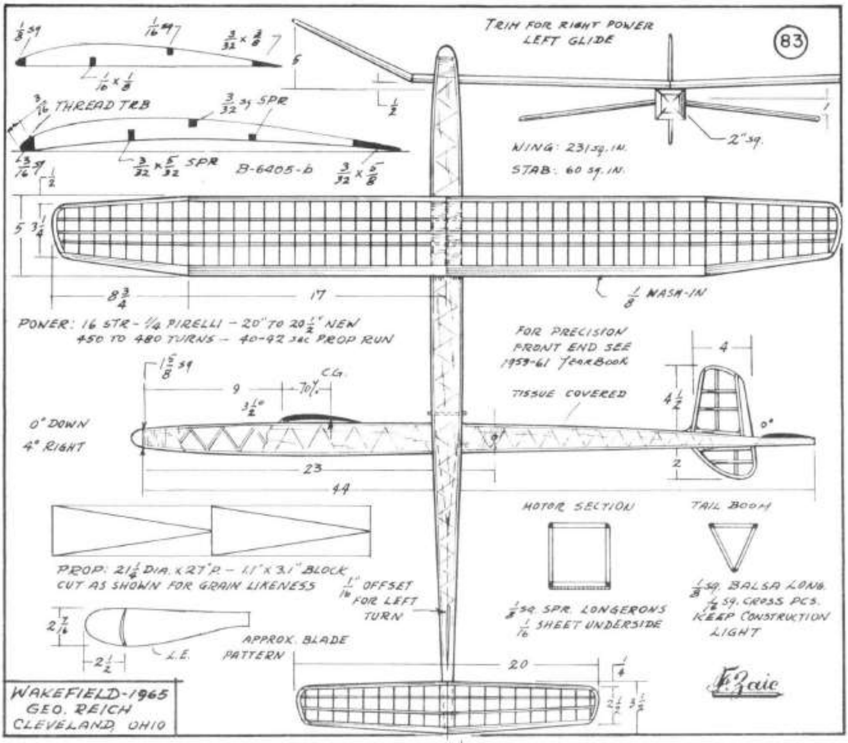
81
ALL BALSA
2x3
3x5
3x15
3x6
3x2 BALSA
2x9 BALSA
3x3 BALSA
130
220
845
20
PROPELLER
56 DIA. x 65 (60) P.
16 STR. "PIRELLI"
440 TURNS
70
24
2.5
47
70
280
110
35
FUSELAGE
TUBE - BALSA 1.5
CONE - SOFT BALSA 0.5
ARM-JOINT - ALUM. FRAMES
3 SCREWS RADIALLY FITTED IN THE ALUM. NOSE FOR THRUST-LINE TRIMMING
+0°45'
C.G. 70%
246
-3°
TATONE D/T
250
130
300
40
113
160
112
30
680
425
3 RD AT 1961 WORLD CHAMPS
500
82
ALL THE MESURES IN MILLIMETRES —
WAKEFIELD —ITALY—
ALINARI ALESSANDRO
S.A.



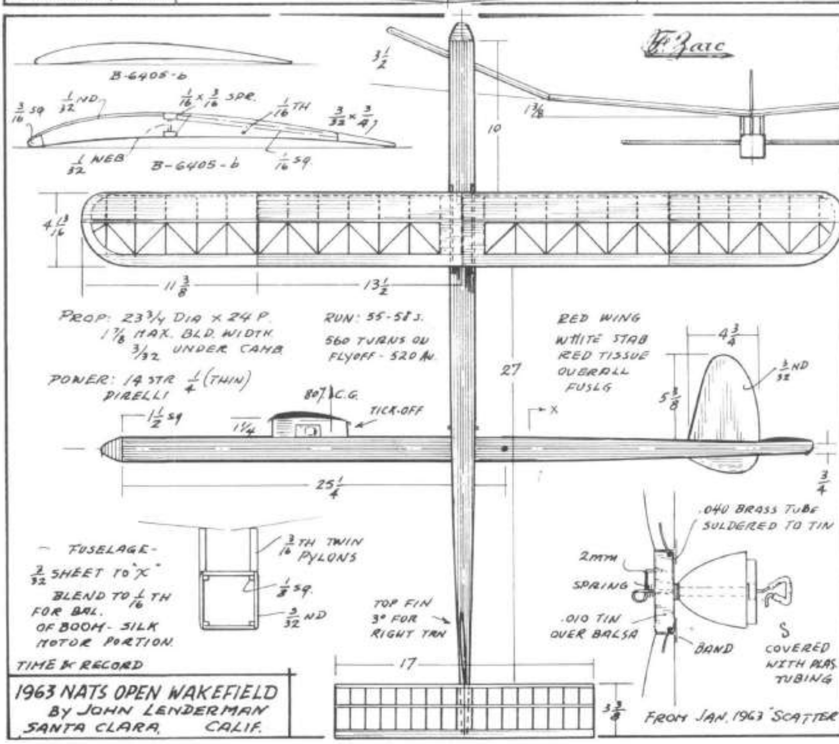
130
85
PLEXIGLASS NOSE
130
110
175
780
175
DETERMALIZER - AUTO KNIPS ADAPTED —
ALL BALSA
82
120
+2°20'
-1°30'
-1°30'
225
190
800
95
575
270
115
TUBE - TWO BALSA SHEETS (0.8 mm) WITH GLASS WOOL INSIDE
ϕ 290
260
68
80
22
31
3RD 1963 WORLD CHAMPS —
PROP. - DIA. 58 - P. 66
16 STR. 1x6 PIRELLI
465
95
"EL MARUSCAN"
WAKEFIELD
BRUNO MURARI - ITALY
S.A.


82
ROUND FUSELAGE SECTION
200
+3°
CG
550
120
25
A
WEIGHT 45 GR
138
600
PINE 2,15
SECTION A-A
GRASS „CSI"
14,8 sqdm
4,0 sqdm
1170
90
FUSELAGE SECTION
BALSA
CELLULOID
BIRCH VENEER (0,8mm)
WORLD CHAMPIONSHIP 1963
WIENER NEUSTADT - AUSTRIA
PLACED 12th - 854 sec.
PROP DETAIL
PROP
WIRE ø 1mm
PLY 3mm
LIME
BALSA
BIND AND SOLDER
CELLULOID
116
WAKEFIELD
BY VLADIMIR ZAPACHNYJ
UDSSR

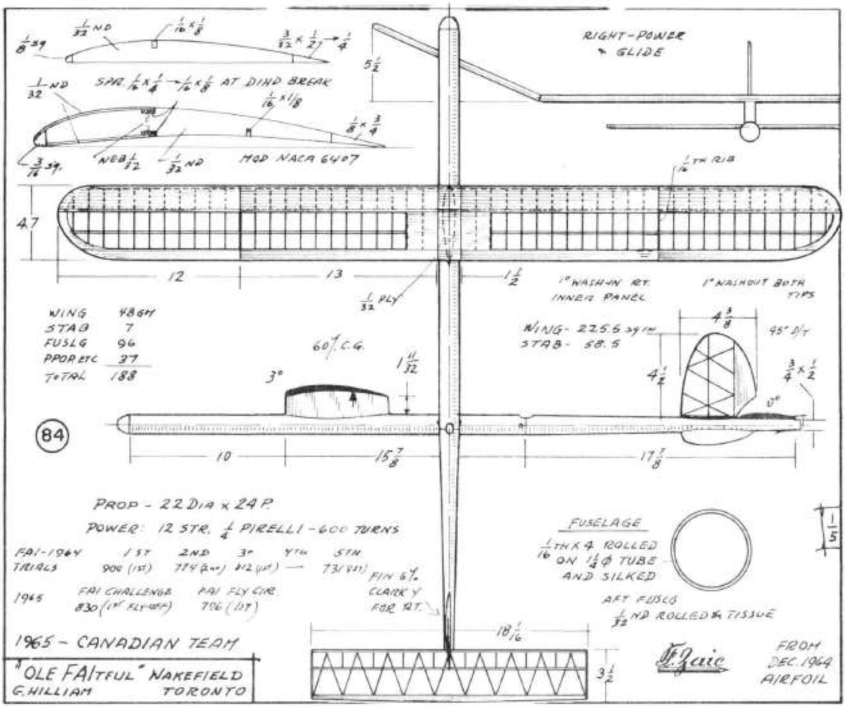

4 x 4
1.0
1.5 x 1.5
3 x 10
1mm
3 x 3 PINE
1.5
3 x 20
3 x 10
B-6405-6
3 x 3
125
2 1/2° RIGHT
30
20
215
82
121
225
370
40
PROP: 540 DIA. 680 P.
POWER: 16 STR 1/4 PIRELLI
670
90
50
65%
50
45
120
1/5
0°
550
35 x 35
FLIGHT: RIGHT - LEFT
2 x 3
2mm
1.5mm
2 x 3
F. Zaic
430
5 TH - 1963 FAI
TISSUE: IN + OUT
"SABRE" WAKEFIELD
ROLF SUNDIN - SWEDEN
88
FROM "PROFILEN"

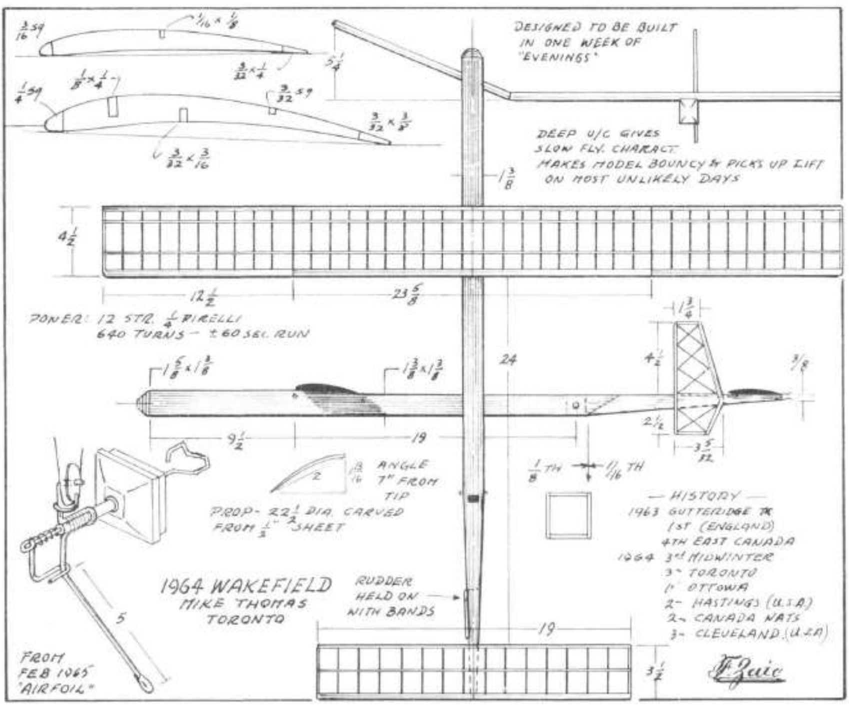


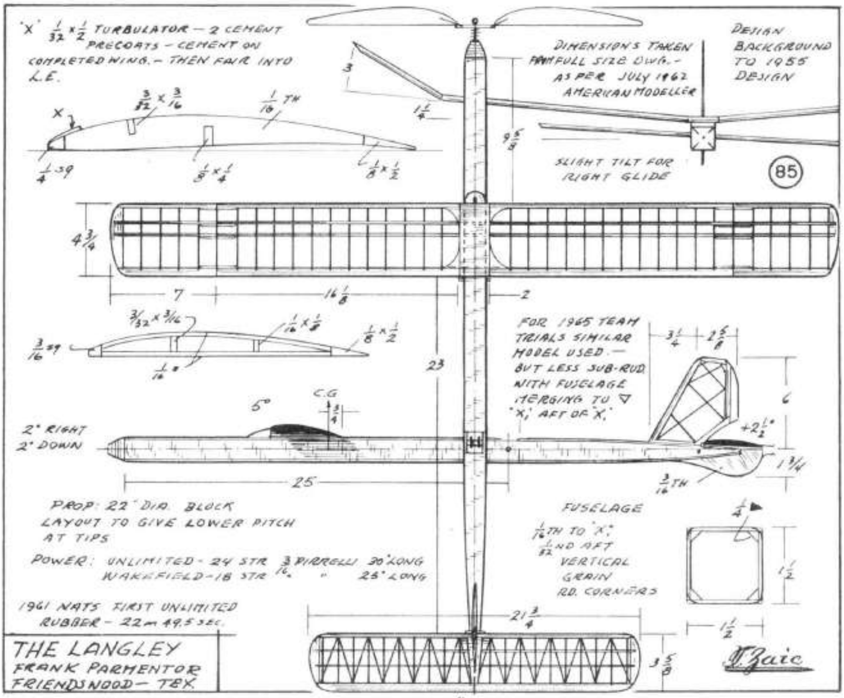
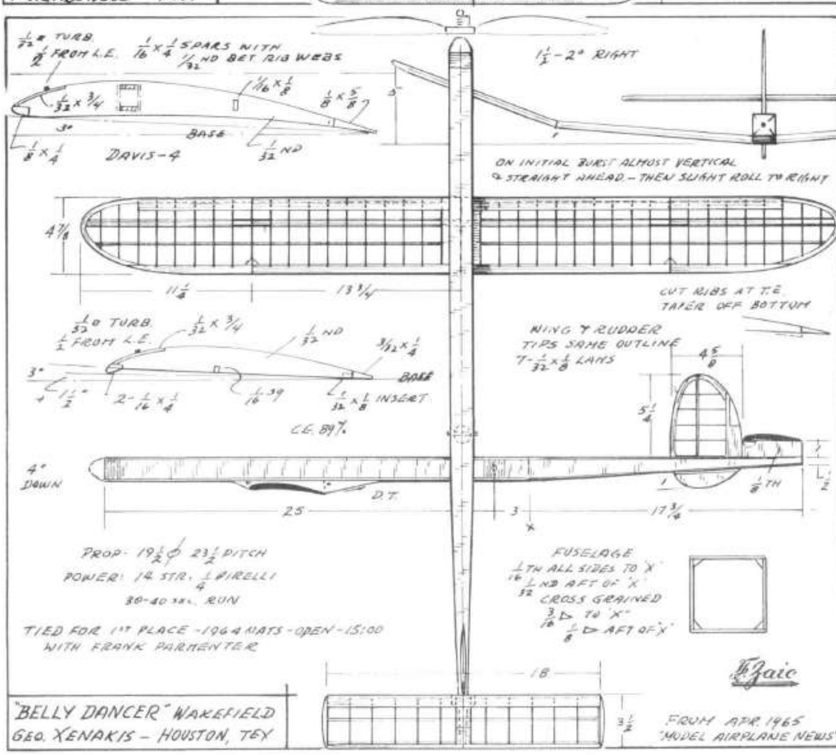
83
TRIM FOR RIGHT POWER
LEFT GLIDE
3/16 THREAD TRB
3/32 sq SPR
3/32 x 5/32 SPR
B-6405-b
WING: 231 sq. IN.
STAB: 60 sq. IN.
2" sq.
1/8 WASH-IN
POWER: 16 STR - 1/4 PIRELLI - 20" TO 20 1/2" NEW
450 TO 480 TURNS - 40-42 sec PROP RUN
FOR PRECISION
FRONT END SEE
1959-61 YEARBOOK
TISSUE COVERED
C.G.
70%
0° DOWN
4° RIGHT
MOTOR SECTION
TAIL BOOM
PROP: 21 1/4 DIA. x 27" P. - 1.1" x 3.1" BLOCK
CUT AS SHOWN FOR GRAIN LIKENESS
1/16" OFFSET
FOR LEFT
TURN
1/8 sq. SPR. LONGERONS
1/16 SHEET UNDERSIDE
1/8 sq. BALSA LONG.
1/16 sq. CROSS PCS.
KEEP CONSTRUCTION
LIGHT
APPROX. BLADE
PATTERN
L.E.
WAKEFIELD-1965
GEO. REICH
CLEVELAND, OHIO
F. Zaic

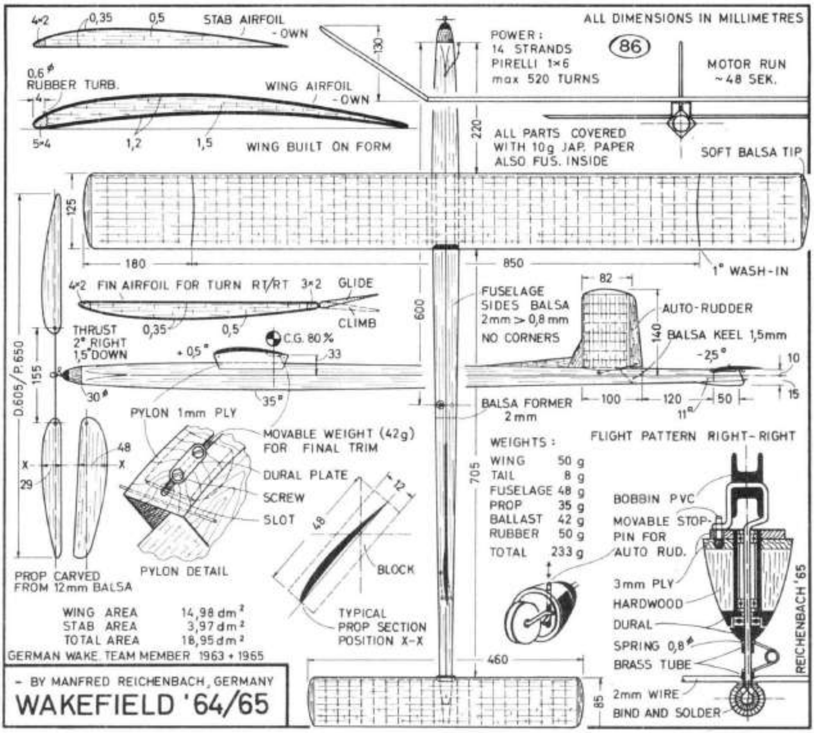


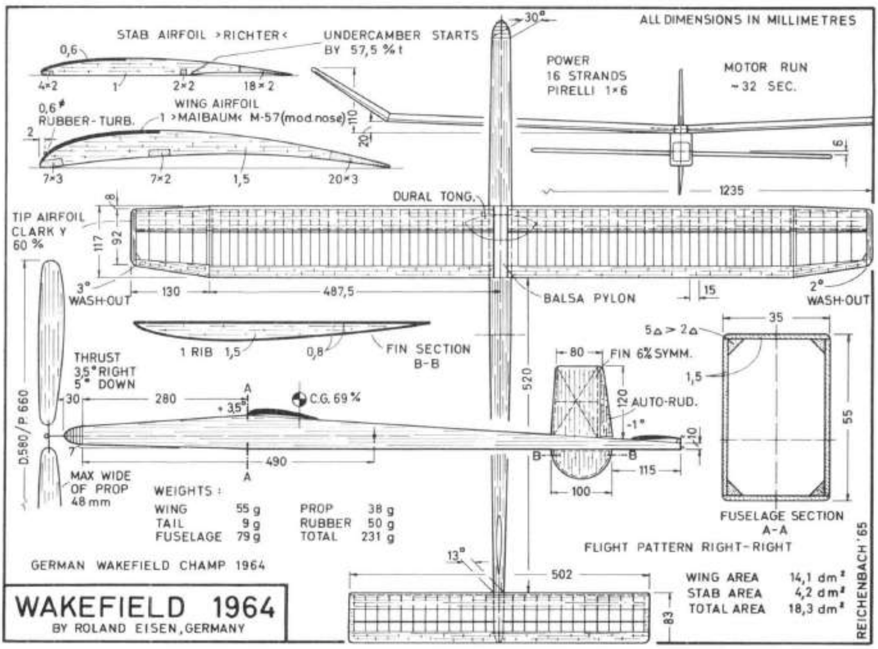
F. Zaic
B-6405-b
1/16 x 3/16 SPR.
1/32 WEB
B-6405-b
PROP: 23 3/4 DIA x 24 P.
1 7/8 MAX. BLD. WIDTH
3/32 UNDER CAMB.
RUN: 55-58 s.
560 TURNS ON
FLYOFF - 520 AV.
RED WING
WHITE STAB
RED TISSUE
OVERALL
FUSLG
POWER: 14 STR 1/4 (THIN)
PIRELLI
80% C.G.
TICK-OFF
.040 BRASS TUBE
SOLDERED TO TIN
- FUSELAGE -
3/32 SHEET TO "X"
BLEND TO 1/16 TH
FOR BAL.
OF BOOM - SILK
MOTOR PORTION
3/16 TH TWIN
PYLONS
2mm
SPRING
.010 TIN
OVER BALSA
BAND
TOP FIN
3° FOR
RIGHT TRN
COVERED
WITH PLAS.
TUBING
TIME K RECORD
1963 NATS OPEN WAKEFIELD
BY JOHN LENDERMAN
SANTA CLARA, CALIF.
FROM JAN. 1963 "SCATTER"

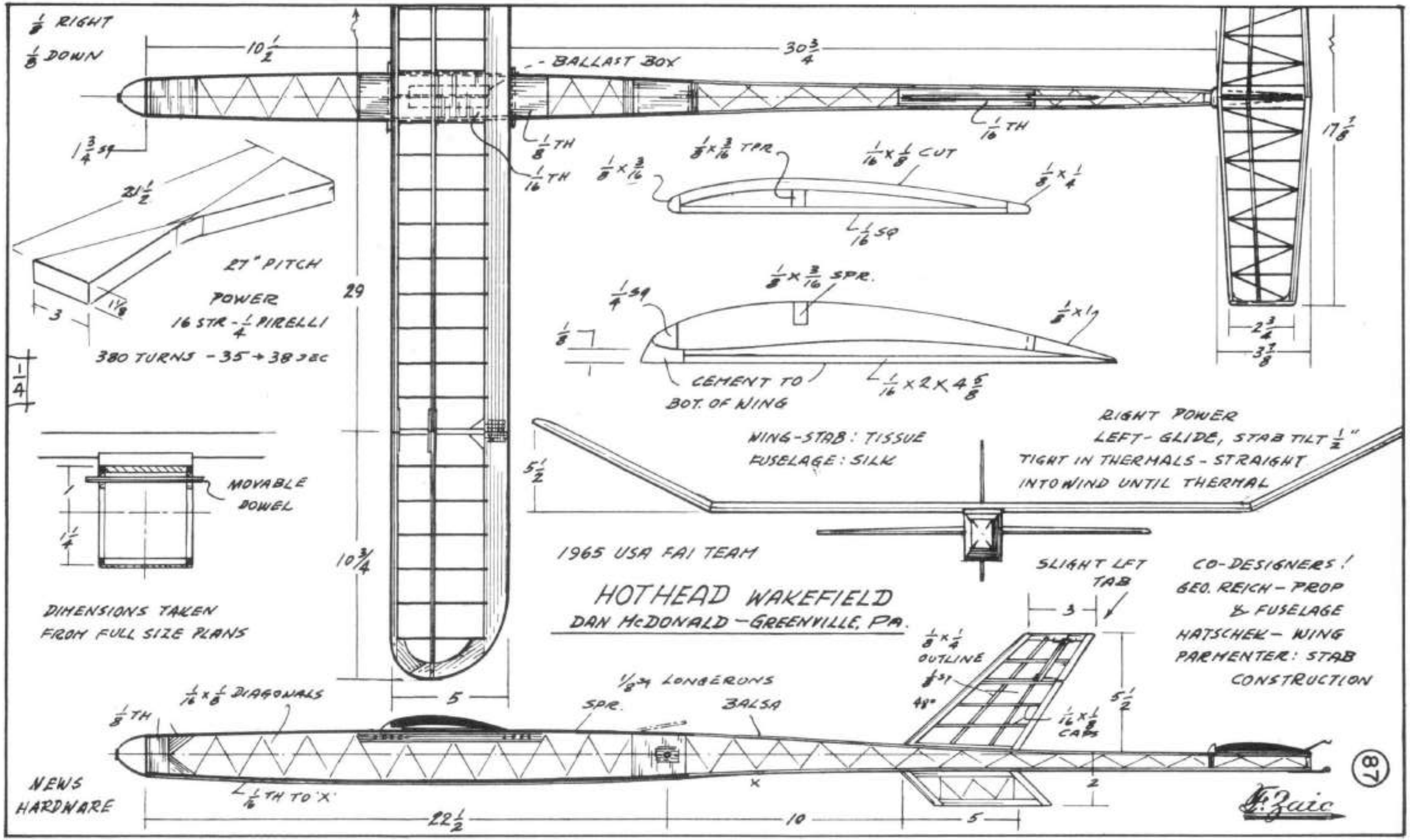

RIGHT-POWER
GLIDE
MOD NACA 6407
WING 48GM
STAB 7
FUSLG 96
PROP ETC 37
TOTAL 188
1° WASHIN RT. INNER PANEL
1° WASHOUT BOTH TIPS
WING- 225.5 sq in
STAB- 58.5
60% C.G.
84
PROP - 22 DIA x 24 P.
POWER: 12 STR. 1/4 PIRELLI - 600 TURNS
FAI CHALLENGE
FAI FLY CIR.
FIN 6%
CLARK Y
FOR RT.
FUSELAGE
AND SILKED
AFT FUSLG
1965 - CANADIAN TEAM
"OLE FAItful" WAKEFIELD
G. WILLIAM TORONTO
F. Zaic
FROM
DEC. 1964
AIRFOIL


DESIGNED TO BE BUILT
IN ONE WEEK OF
"EVENINGS"
DEEP U/C GIVES
SLOW FLY. CHARACT.
MAKES MODEL BOUNCY & PICKS UP LIFT
ON MOST UNLIKELY DAYS
POWER: 12 STR. 1/4 PIRELLI
640 TURNS - ±60 SEC. RUN
ANGLE
7" FROM
TIP
PROP- 22 1/2 DIA. CARVED
FROM 1/2" SHEET
— HISTORY —
1963 GUTTERIDGE TR
1ST (ENGLAND)
4TH EAST CANADA
1964 3rd MIDWINTER
3rd TORONTO
1st OTTOWA
2- HASTINGS (U.S.A.)
2- CANADA NATS
3- CLEVELAND (U.S.A.)
1964 WAKEFIELD
MIKE THOMAS
TORONTO
RUDDER
HELD ON
WITH BANDS
FROM
FEB 1965
"AIRFOIL"
F. Zaic

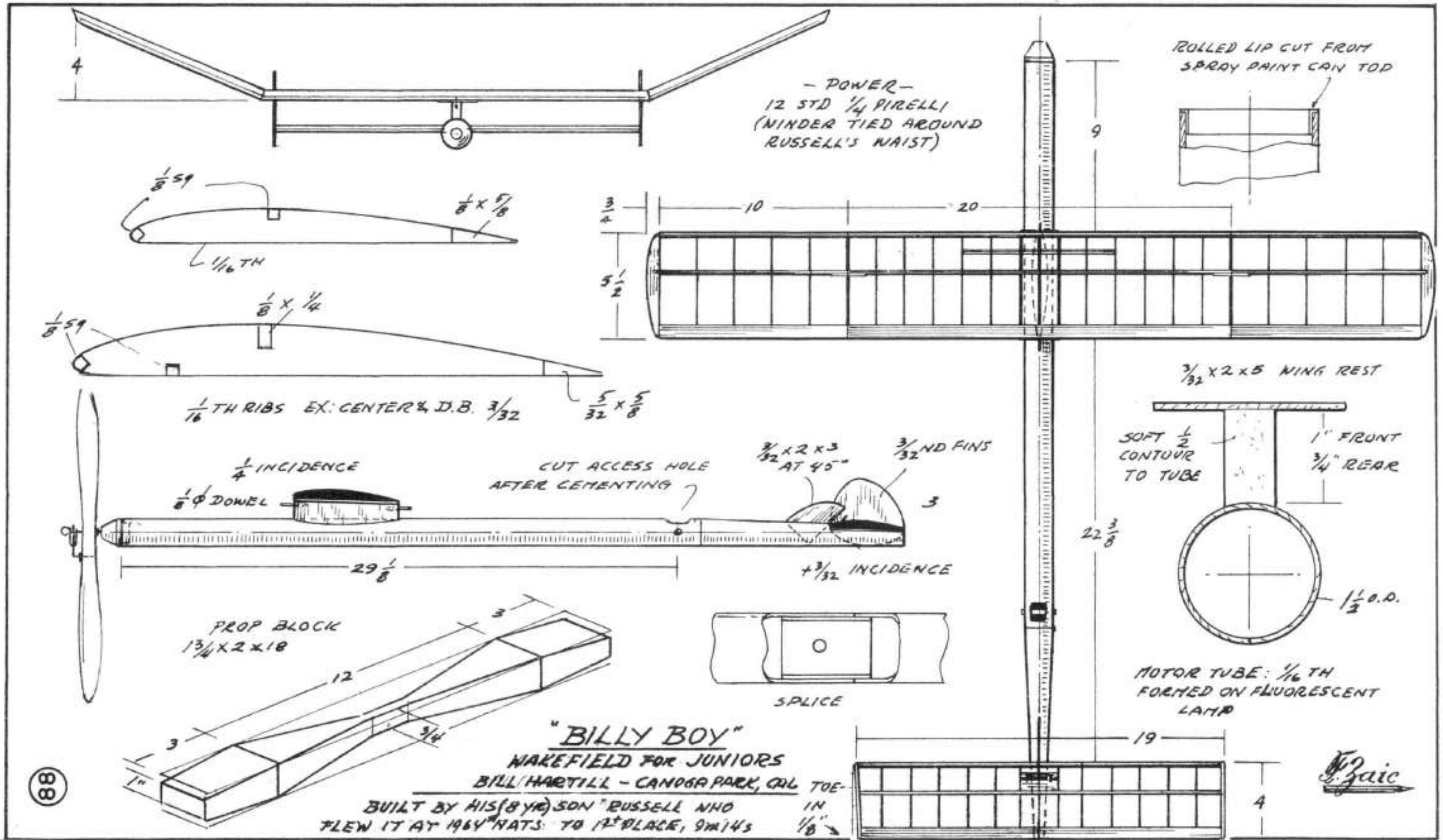

"X" 1/32 x 1/2 TURBULATOR — 2 CEMENT PRECOATS — CEMENT ON COMPLETED WING. — THEN FAIR INTO L.E.
DIMENSIONS TAKEN FROM FULL SIZE DWG. — AS PER JULY 1962 AMERICAN MODELLER
DESIGN BACKGROUND TO 1955 DESIGN
SLIGHT TILT FOR RIGHT GLIDE
85
FOR 1965 TEAM TRIALS SIMILAR MODEL USED. — BUT LESS SUB-RUD. WITH FUSELAGE MERGING TO ▽ "X," AFT OF "X."
2° RIGHT
2° DOWN
PROP: 22" DIA. BLOCK LAYOUT TO GIVE LOWER PITCH AT TIPS
POWER: UNLIMITED - 24 STR 3/16 PIRELLI 30" LONG
WAKEFIELD - 18 STR " 25" LONG
FUSELAGE
1/16 TH TO "X"
1/32 ND AFT
VERTICAL GRAIN
RD. CORNERS
1961 NATS FIRST UNLIMITED RUBBER — 22 m 49.5 SEC.
THE LANGLEY
FRANK PARMENTOR
FRIENDSWOOD — TEX.
F. Zaic

1/32 ▫ TURB. 1/2 FROM L.E.
1/16 x 1/4 SPARS WITH 1/32 ND BET. RIB WEBS
1 1/2 - 2° RIGHT
DAVIS - 4
ON INITIAL BURST ALMOST VERTICAL & STRAIGHT AHEAD. — THEN SLIGHT ROLL TO RIGHT
CUT RIBS AT T.E. TAPER OFF BOTTOM
WING & RUDDER TIPS SAME OUTLINE 7 - 1/32 x 1/8 LAMS
C.E. 89%
4° DOWN
D.T.
PROP - 19 1/2 ⌀ 23 1/2 PITCH
POWER: 14 STR. 1/4 PIRELLI
30-40 SEC. RUN
FUSELAGE
1/16 TH ALL SIDES TO "X"
1/32 ND AFT OF "X"
CROSS GRAINED
3/16 ▷ TO "X"
1/8 ▷ AFT OF "X"
TIED FOR 1ST PLACE - 1964 NATS - OPEN - 15:00 WITH FRANK PARMENTER
"BELLY DANCER" WAKEFIELD
GEO. XENAKIS — HOUSTON, TEX
FROM APR. 1965 "MODEL AIRPLANE NEWS"
F. Zaic


ALL DIMENSIONS IN MILLIMETRES
86
STAB AIRFOIL - OWN
WING AIRFOIL - OWN
0,6 RUBBER TURB.
WING BUILT ON FORM
POWER: 14 STRANDS PIRELLI 1×6 max 520 TURNS
MOTOR RUN ~48 SEK.
ALL PARTS COVERED WITH 10g JAP. PAPER ALSO FUS. INSIDE
SOFT BALSA TIP
1° WASH-IN
FIN AIRFOIL FOR TURN RT/RT
GLIDE
CLIMB
THRUST 2° RIGHT 1,5° DOWN
C.G. 80 %
FUSELAGE SIDES BALSA 2mm > 0,8 mm NO CORNERS
AUTO-RUDDER
BALSA KEEL 1,5mm
BALSA FORMER 2 mm
PYLON 1mm PLY
MOVABLE WEIGHT (42g) FOR FINAL TRIM
DURAL PLATE
SCREW
SLOT
BLOCK
PYLON DETAIL
PROP CARVED FROM 12mm BALSA
TYPICAL PROP SECTION POSITION X-X
D.605/P.650
WEIGHTS:
WING 50 g
TAIL 8 g
FUSELAGE 48 g
PROP 35 g
BALLAST 42 g
RUBBER 50 g
TOTAL 233 g
FLIGHT PATTERN RIGHT-RIGHT
BOBBIN PVC
MOVABLE STOP-PIN FOR AUTO RUD.
3mm PLY
HARDWOOD
DURAL
SPRING 0,8
BRASS TUBE
2mm WIRE
BIND AND SOLDER
WING AREA 14,98 dm²
STAB AREA 3,97 dm²
TOTAL AREA 18,95 dm²
GERMAN WAKE. TEAM MEMBER 1963 + 1965
- BY MANFRED REICHENBACH, GERMANY
WAKEFIELD '64/65
REICHENBACH '65

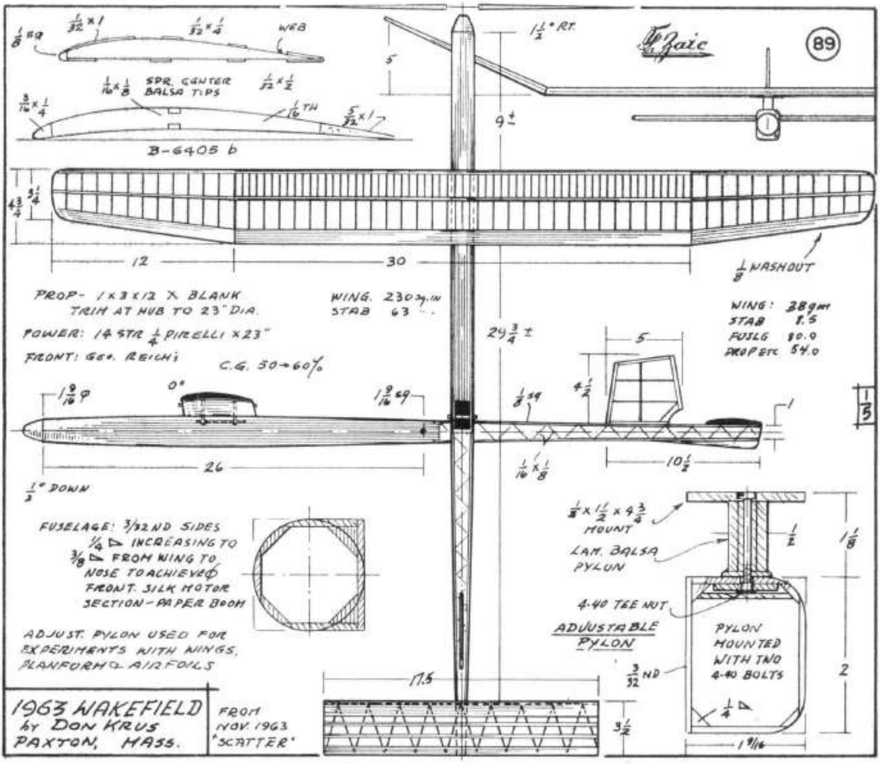

ALL DIMENSIONS IN MILLIMETRES
STAB AIRFOIL >RICHTER<
UNDERCAMBER STARTS BY 57,5 % t
WING AIRFOIL >MAIBAUM< M-57(mod.nose)
0,6 RUBBER-TURB.
POWER 16 STRANDS PIRELLI 1×6
MOTOR RUN ~32 SEC.
DURAL TONG.
TIP AIRFOIL CLARK Y 60 %
3° WASH-OUT
BALSA PYLON
2° WASH-OUT
1 RIB 1,5
FIN SECTION B-B
FIN 6% SYMM.
AUTO-RUD.
THRUST 3,5° RIGHT 5° DOWN
C.G. 69 %
D.580/P.660
MAX WIDE OF PROP 48 mm
WEIGHTS:
WING 55 g
TAIL 9 g
FUSELAGE 79 g
PROP 38 g
RUBBER 50 g
TOTAL 231 g
FUSELAGE SECTION A-A
FLIGHT PATTERN RIGHT-RIGHT
GERMAN WAKEFIELD CHAMP 1964
WING AREA 14,1 dm²
STAB AREA 4,2 dm²
TOTAL AREA 18,3 dm²
WAKEFIELD 1964
BY ROLAND EISEN, GERMANY
REICHENBACH '65



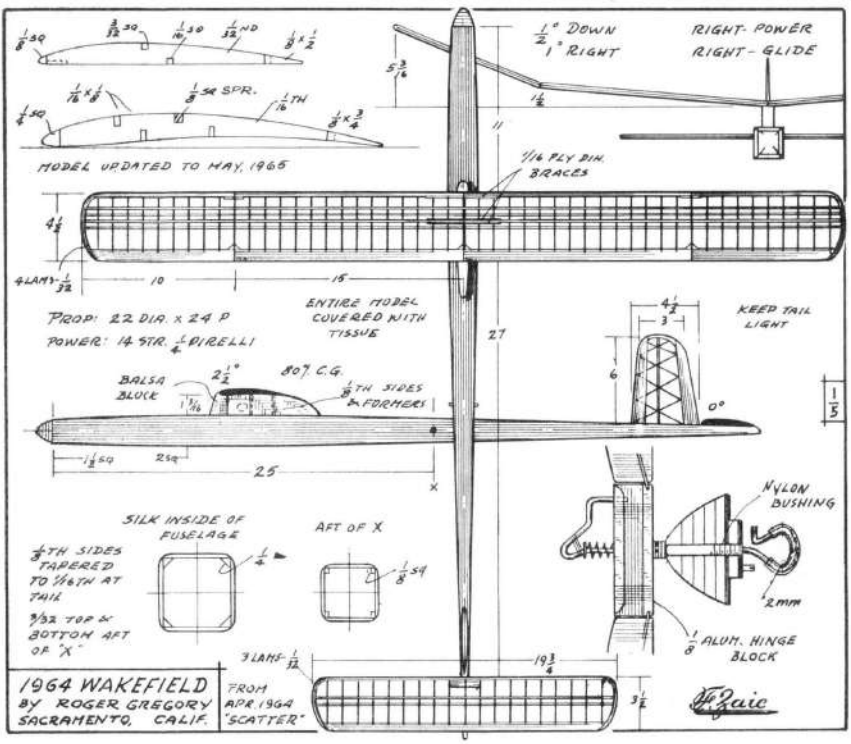
1/8 RIGHT
1/8 DOWN
10 1/2
30 3/4
BALLAST BOX
1 3/4 SQ
1/8 TH
1/16 TH
1/16 TH
17 1/8
1/8 x 3/16 TPR
1/16 x 1/8 CUT
1/8 x 3/16
1/8 x 1/4
1/16 SQ
21 1/2
27" PITCH
POWER
16 STR - 1/4 PIRELLI
380 TURNS - 35 + 38 SEC
29
3
1 1/8
1/4
1/8 x 3/16 SPR.
1/4 SQ
1/8 x 1
1/8
CEMENT TO
BOT. OF WING
1/16 x 2 x 4 5/8
2 3/4
3 7/8
RIGHT POWER
LEFT - GLIDE, STAB TILT 1/2"
TIGHT IN THERMALS - STRAIGHT
INTO WIND UNTIL THERMAL
WING-STAB : TISSUE
FUSELAGE : SILK
5 1/2
MOVABLE
DOWEL
1
1 1/4
10 3/4
1965 USA FAI TEAM
HOTHEAD WAKEFIELD
DAN McDONALD - GREENVILLE, PA.
SLIGHT LFT
TAB
CO-DESIGNERS !
GEO. REICH - PROP
& FUSELAGE
HATSCHEK - WING
PARMENTER : STAB
CONSTRUCTION
DIMENSIONS TAKEN
FROM FULL SIZE PLANS
3
1/8 x 1/4
OUTLINE
48°
5 1/2
1/16 x 1/8
CAPS
5
1/8 SQ LONGERONS
SPR.
BALSA
1/8 TH
1/16 x 1/8 DIAGONALS
1/16 TH TO 'X'
X
2
NEWS
HARDWARE
22 1/2
10
5
87



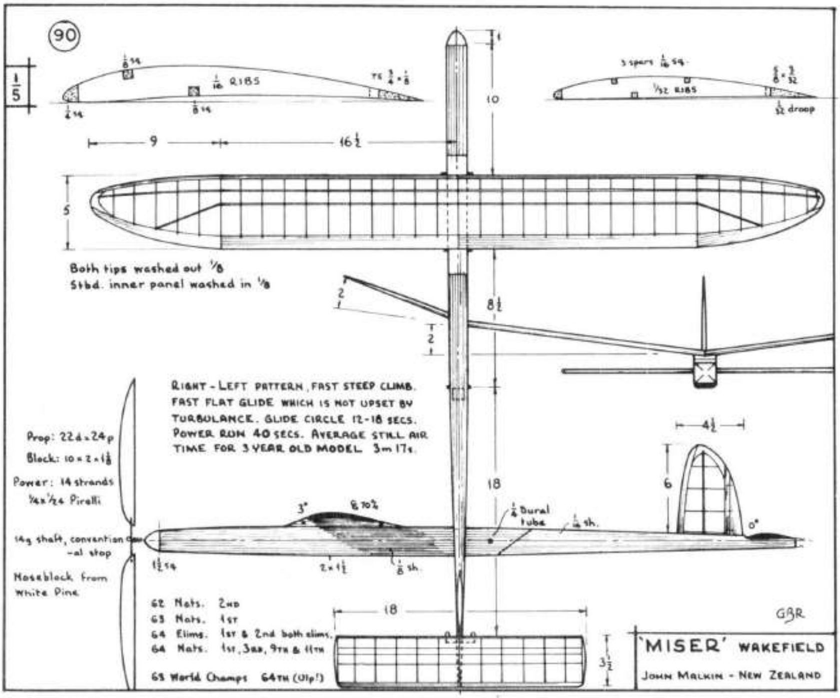
- POWER -
12 STD 1/4 PIRELLI
(WINDER TIED AROUND RUSSELL'S WAIST)
ROLLED LIP CUT FROM SPRAY PAINT CAN TOP
1/8 SQ
1/8 x 5/8
1/16 TH
1/8 x 1/4
1/16 TH RIBS EX: CENTER & D.B. 3/32
5/32 x 5/8
1/4 INCIDENCE
1/8 Φ DOWEL
CUT ACCESS HOLE AFTER CEMENTING
3/32 x 2 x 3 AT 45°
3/32 ND FINS
+3/32 INCIDENCE
29 1/8
3/32 x 2 x 5 WING REST
SOFT 1/2 CONTOUR TO TUBE
1" FRONT
3/4" REAR
1 1/2 O.D.
PROP BLOCK
1 3/4 x 2 x 18
SPLICE
MOTOR TUBE: 1/16 TH FORMED ON FLUORESCENT LAMP
TOE-IN 1/8
"BILLY BOY"
WAKEFIELD FOR JUNIORS
BILL HARTILL - CANOGA PARK, CAL
BUILT BY HIS (8 YR) SON "RUSSELL WHO FLEW IT AT 1964 NATS TO 1st PLACE, 9m 14s
88

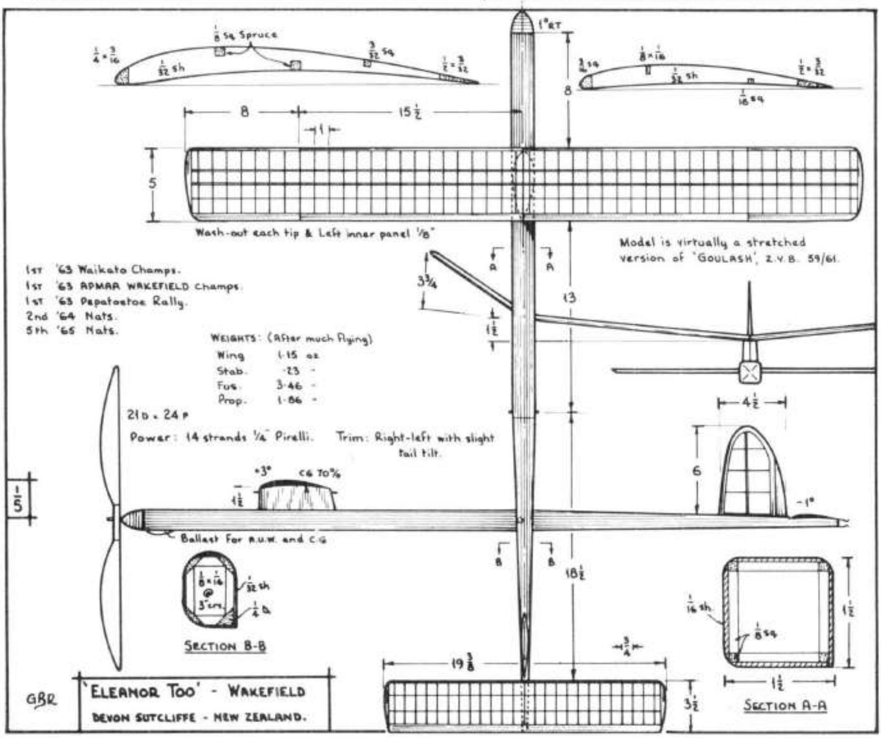


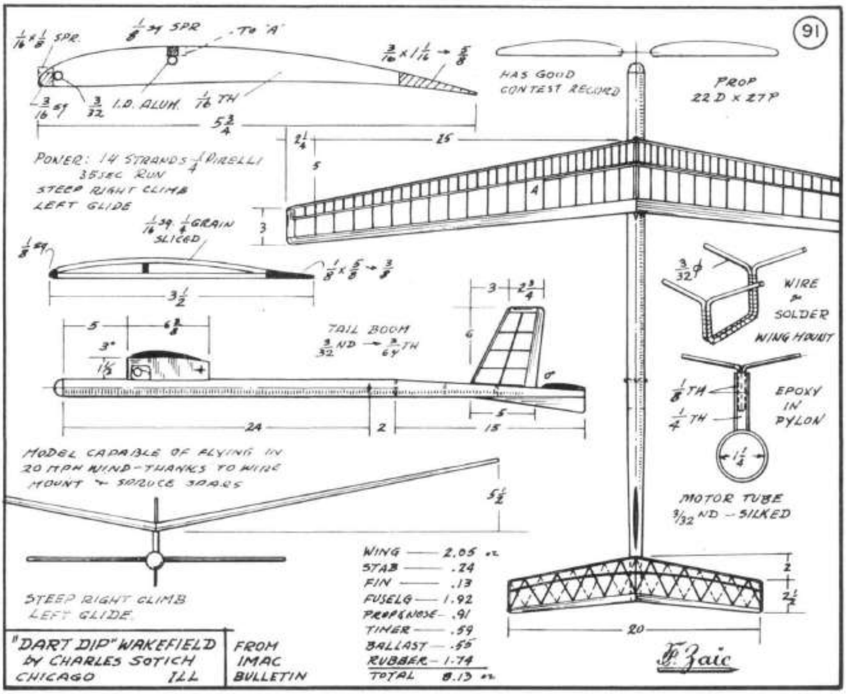
89
Zaic
1/8 SQ
1/32 x 1
1/32 x 1/4
WEB
1/16 x 1/8
SPR. CENTER
BALSA TIPS
1/32 x 1/2
3/16 x 1/4
1/16 TH
5/32 x 1
B-6405 b
1 1/2° RT.
5
9 1/4
4 3/4
3 1/4
12
30
1/8 WASHOUT
PROP- 1 x 3 x 12 X BLANK
TRIM AT HUB TO 23" DIA.
POWER: 14 STR 1/4 PIRELLI x 23"
FRONT: GEO. REICH
WING. 230 sq. in
STAB 63
WING: 38 gm
STAB 8.5
FUSLG 80.0
PROP ETC 54.0
C.G. 50→60%
29 3/4 ±
5
4 1/2
0°
1 9/16 φ
1 9/16 SQ
1/8 SQ
1
1/3
26
10 1/2
1/16 x 1/8
1/2° DOWN
FUSELAGE: 3/32ND SIDES
1/4 ▷ INCREASING TO
3/8 ▷ FROM WING TO
NOSE TO ACHIEVE φ
FRONT. SILK MOTOR
SECTION - PAPER BOOM
1/8 x 1 1/2 x 4 3/4
MOUNT
LAM. BALSA
PYLON
1/2
1 1/8
4-40 TEE NUT
ADJUSTABLE
PYLON
PYLON
MOUNTED
WITH TWO
4-40 BOLTS
2
3/32 ND
1/4 ▷
1 9/16
ADJUST. PYLON USED FOR
EXPERIMENTS WITH WINGS,
PLANFORM & AIRFOILS
17.5
3 1/2
1963 WAKEFIELD
by DON KRUS
PAXTON, MASS.
FROM
NOV. 1963
"SCATTER"

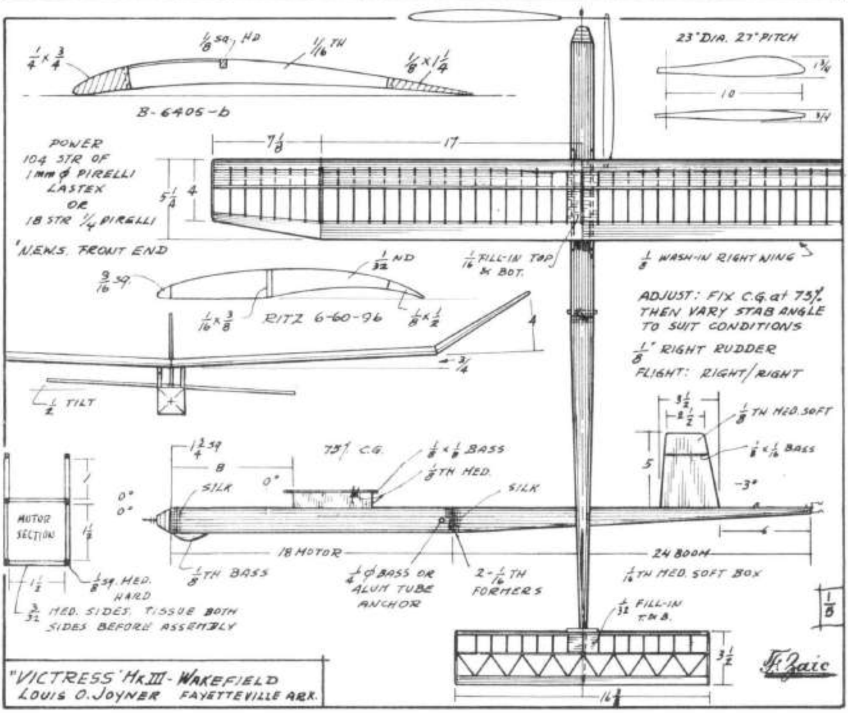


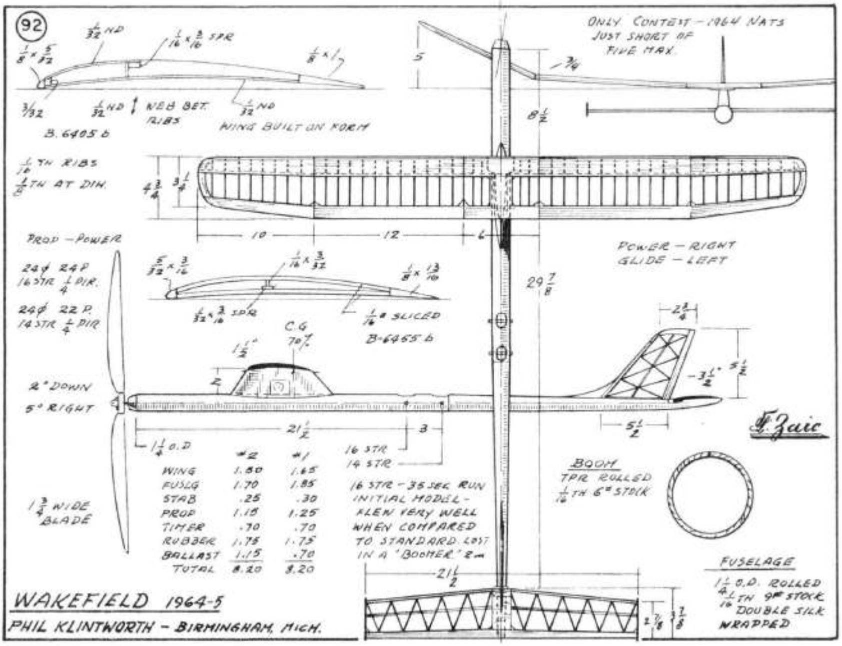
1/8 SQ
3/32 SQ
1/16 SQ
1/32 ND
1/8 x 1/2
1/2° DOWN
1° RIGHT
RIGHT - POWER
RIGHT - GLIDE
5 3/16
1/16 x 1/8
1/8 SQ SPR.
1/16 TH
1/4 SQ
1/8 x 3/4
1 1/2
11
MODEL UPDATED TO MAY, 1965
1/16 PLY DIH.
BRACES
4 1/2
4 LAMS - 1/32
10
15
PROP: 22 DIA. x 24 P
POWER: 14 STR. 1/4 PIRELLI
ENTIRE MODEL
COVERED WITH
TISSUE
27
4 1/2
3
KEEP TAIL
LIGHT
6
BALSA
BLOCK
2 1/2°
80% C.G.
1 3/16
1/8 TH SIDES
& FORMERS
0°
1/5
1 1/2 SQ
2 SQ
25
X
SILK INSIDE OF
FUSELAGE
AFT OF X
NYLON
BUSHING
1/8 TH SIDES
TAPERED
TO 1/16 TH AT
TAIL
1/4
1/8 SQ
2 mm
3/32 TOP &
BOTTOM AFT
OF "X"
1/8 ALUM. HINGE
BLOCK
3 LAMS - 1/32
19 3/4
3 1/2
Zaic
1964 WAKEFIELD
BY ROGER GREGORY
SACRAMENTO, CALIF.
FROM
APR. 1964
"SCATTER"


90
Both tips washed out 1/8
Stbd. inner panel washed in 1/8
RIGHT - LEFT PATTERN, FAST STEEP CLIMB. FAST FLAT GLIDE WHICH IS NOT UPSET BY TURBULANCE. GLIDE CIRCLE 12-18 SECS. POWER RUN 40 SECS. AVERAGE STILL AIR TIME FOR 3 YEAR OLD MODEL 3m 17s.
Prop: 22d × 24p
Block: 10 × 2 × 1 3/8
Power: 14 strands 1/4 × 1/24 Pirelli
14g shaft, conventional stop
Noseblock from White Pine
1/4 Dural tube
62 Nats. 2ND
63 Nats. 1ST
64 Elims. 1st & 2nd both elims.
64 Nats. 1st, 3RD, 9TH & 11TH
65 World Champs 64TH (Ulp!)
GBR
'MISER' WAKEFIELD
JOHN MALKIN - NEW ZEALAND

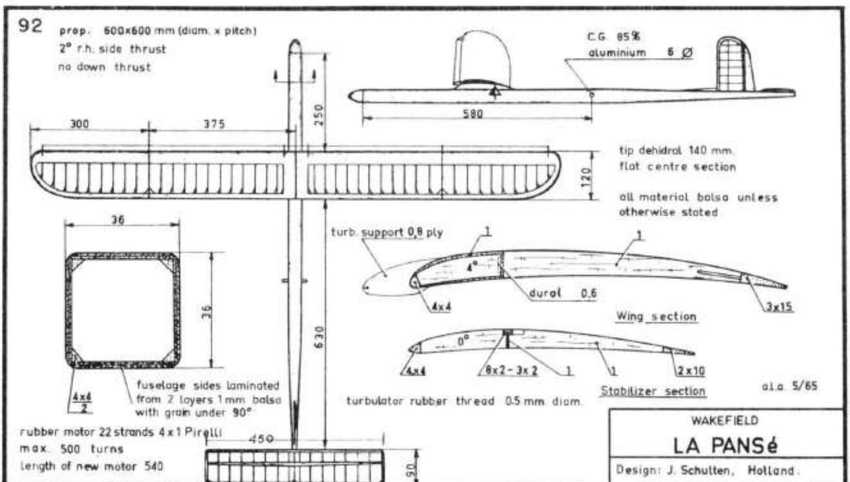

1/8 sq Spruce
Wash-out each tip & Left inner panel 1/8"
Model is virtually a stretched version of 'GOULASH', Z.V.B. 59/61.
1st '63 Waikato Champs.
1st '63 APMAR WAKEFIELD Champs.
1st '63 Papatoetoe Rally.
2nd '64 Nats.
5th '65 Nats.
WEIGHTS: (After much flying)
Wing 1·15 oz
Stab. ·23 -
Fus. 3·46 -
Prop. 1·86 -
21D × 24P
Power: 14 strands 1/4" Pirelli.
Trim: Right-left with slight tail tilt.
Ballast for R.U.W. and C.G.
SECTION B-B
SECTION A-A
GBR
'ELEANOR TOO' - WAKEFIELD
DEVON SUTCLIFFE - NEW ZEALAND.


91
1/16 x 1/8 SPR.
1/8 SQ SPR
TO 'A'
3/16 x 1 1/16 → 5/8
3/16 SQ
3/32 I.D. ALUM.
1/16 TH
5 3/4
HAS GOOD CONTEST RECORD
PROP 22 D x 27 P
POWER: 14 STRANDS 1/4 PIRELLI
35 SEC RUN
STEEP RIGHT CLIMB
LEFT GLIDE
1/16 SQ. 1/4 GRAIN SLICED
1/8 SQ
1/8 x 5/8 → 3/8
3 1/2
TAIL BOOM 3/32 MD → 3/64 TH
WIRE & SOLDER WING MOUNT
3/32 φ
EPOXY IN PYLON
1/8 TH
1/4 TH
MODEL CAPABLE OF FLYING IN 20 MPH WIND - THANKS TO WIRE MOUNT + SPRUCE SPARS
MOTOR TUBE 3/32 MD - SILKED
STEEP RIGHT CLIMB
LEFT GLIDE
WING — 2.05 oz
STAB — .24
FIN — .13
FUSELG — 1.92
PROP & NOSE — .91
TIMER — .59
BALLAST — .55
RUBBER — 1.74
TOTAL 8.13 oz
"DART DIP" WAKEFIELD
BY CHARLES SOTICH
CHICAGO ILL
FROM IMAC BULLETIN
F. Zaic

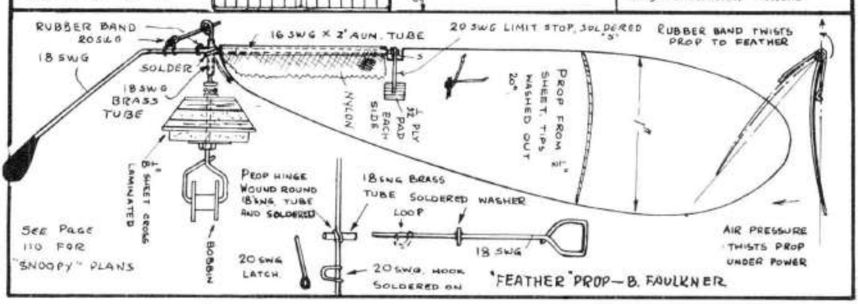

1/4 x 3/4
1/8 SQ. MD
1/16 TH
1/8 x 1 1/4
B-6405-b
23" DIA. 27" PITCH
POWER
104 STR OF 1mm φ PIRELLI LASTEX
OR
18 STR 1/4 PIRELLI
'NEWS. FRONT END
1/16 FILL-IN TOP & BOT.
1/8 WASH-IN RIGHT WING
9/16 SQ.
1/32 MD
1/16 x 3/8
RITZ 6-60-96
1/8 x 1/2
ADJUST: FIX C.G. at 75%
THEN VARY STAB ANGLE TO SUIT CONDITIONS
1/8" RIGHT RUDDER
FLIGHT: RIGHT/RIGHT
1/2 TILT
1/8 TH MED. SOFT
1/8 x 1/16 BASS
75% C.G.
1/8 x 1/8 BASS
1/8 TH MED.
SILK
MOTOR SECTION
18 MOTOR
24 BOOM
1/8 TH BASS
1/4 φ BASS OR ALUM TUBE ANCHOR
2 - 1/16 TH FORMERS
1/16 TH MED. SOFT BOX
1/8 SQ. MED. HARD
3/32 MED. SIDES. TISSUE BOTH SIDES BEFORE ASSEMBLY
1/32 FILL-IN T & B.
"VICTRESS" Mk III - WAKEFIELD
LOUIS O. JOYNER FAYETTEVILLE ARK.
F. Zaic



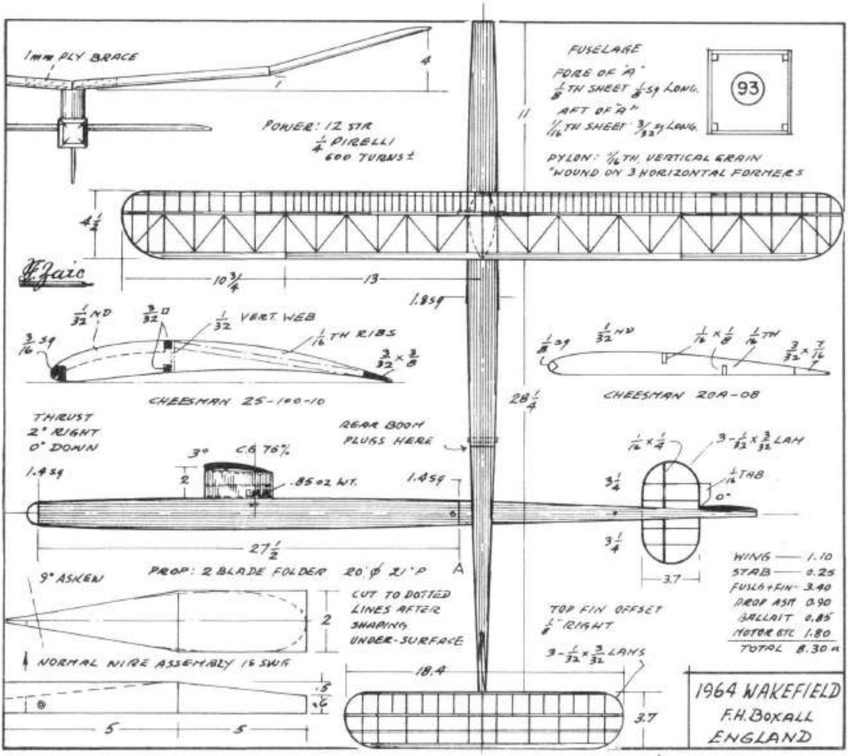
92
ONLY CONTEST - 1964 NATS JUST SHORT OF FIVE MAX.
WING BUILT ON FORM
B. 6405 b
PROP - POWER
POWER - RIGHT GLIDE - LEFT
2° DOWN
5° RIGHT
$1\frac{3}{4}$ WIDE BLADE
B-6455 b
C.G 70%
16 STR - 35 SEC RUN INITIAL MODEL - FLEW VERY WELL WHEN COMPARED TO STANDARD. LOST IN A "BOOMER" 2nd
BOOM TPR ROLLED $\frac{1}{16}$ TH 6# STOCK
FUSELAGE $1\frac{1}{4}$ O.D. ROLLED $\frac{1}{16}$ TH 9# STOCK DOUBLE SILK WRAPPED
WING 1.80 1.65
FUSLG 1.70 1.85
STAB .25 .30
PROP 1.15 1.25
TIMER .70 .70
RUBBER 1.75 1.75
BALLAST 1.15 .70
TOTAL 8.20 8.20
WAKEFIELD 1964-5
PHIL KLINTWORTH - BIRMINGHAM, MICH.



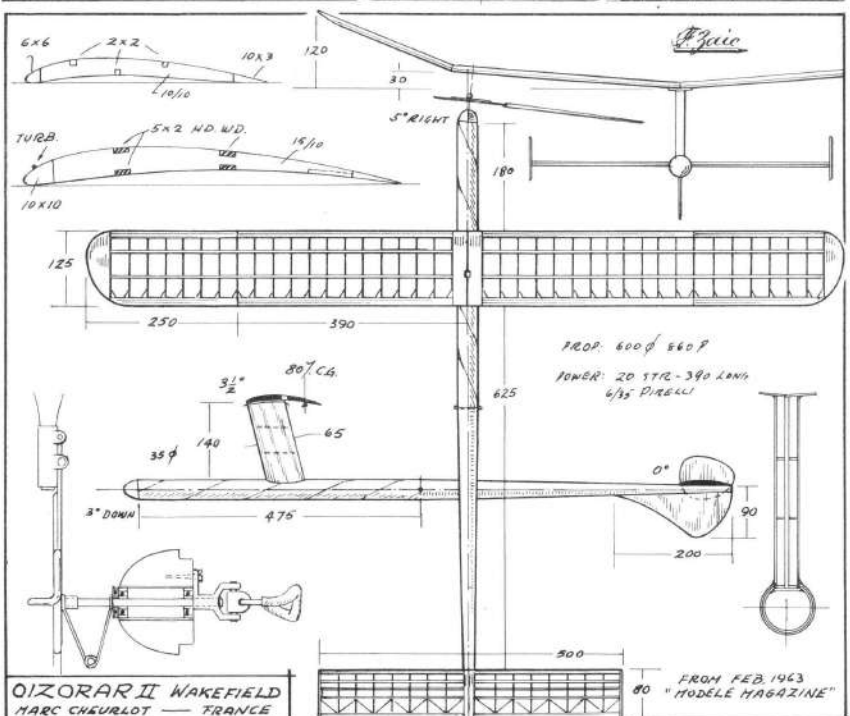
92
prop. 600x600 mm (diam. x pitch)
2° r.h. side thrust
no down thrust
C.G. 85%
aluminium 6 Ø
tip dehidral 140 mm.
flat centre section
all material balsa unless otherwise stated
turb. support 0,8 ply
dural 0,6
Wing section
Stabilizer section
fuselage sides laminated from 2 layers 1 mm balsa with grain under 90°
turbulator rubber thread 0.5 mm diam.
rubber motor 22 strands 4 x 1 Pirelli
max. 500 turns
length of new motor 540
a.l.a. 5/65
WAKEFIELD
LA PANSé
Design: J. Schulten, Holland.



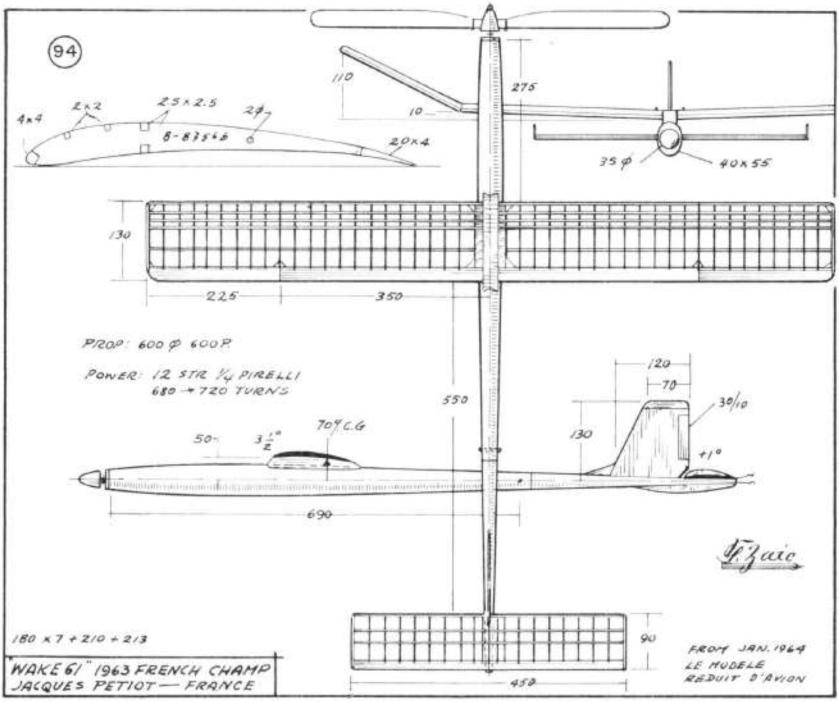
RUBBER BAND
18 SWG
SOLDER
18 SWG BRASS TUBE
16 SWG × 2" ALUM. TUBE
20 SWG LIMIT STOP, SOLDERED
RUBBER BAND TWISTS PROP TO FEATHER
NYLON
PROP FROM SHEET. TIPS WASHED OUT 20°
PROP HINGE WOUND ROUND 18 SWG TUBE AND SOLDERED
18 SWG BRASS TUBE
SOLDERED WASHER
LOOP
18 SWG
BOBBIN
20 SWG LATCH
20 SWG. HOOK SOLDERED ON
AIR PRESSURE TWISTS PROP UNDER POWER
SEE PAGE 110 FOR "SNOOPY" PLANS
"FEATHER" PROP - B. FAULKNER

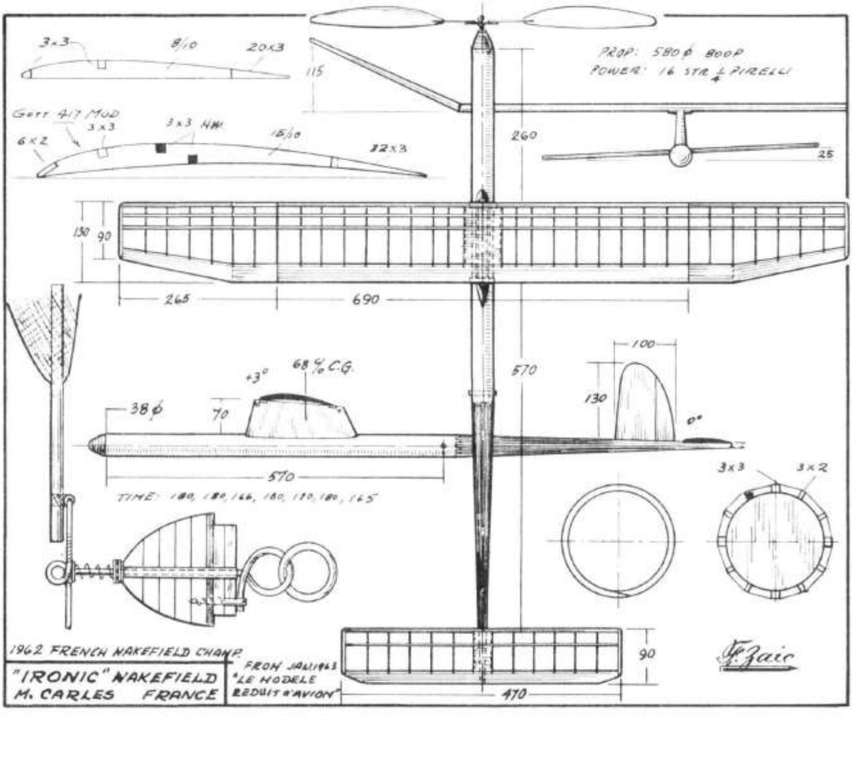


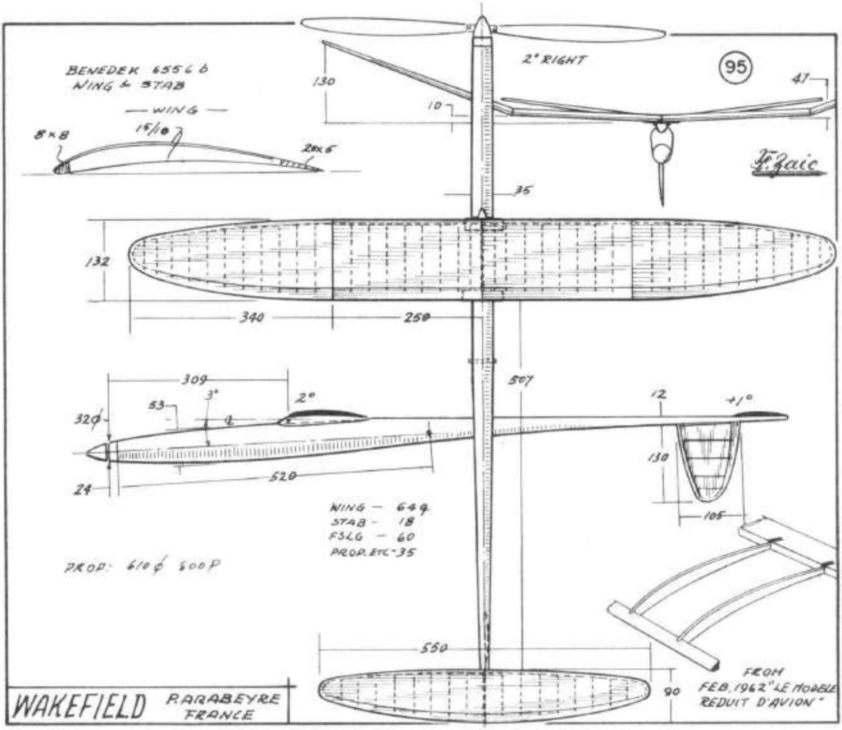
1mm PLY BRACE
POWER: 12 STR
1/4 PIRELLI
600 TURNS ±
FUSELAGE
FORE OF "A"
1/8 TH SHEET 1/8 sq LONG.
AFT OF "A"
1/16 TH SHEET 3/32 sq LONG.
PYLON: 1/16 TH. VERTICAL GRAIN
"WOUND ON 3 HORIZONTAL FORMERS
93
10 3/4
13
1.85 sq
1/32 HD
3/32 □
1/32 VERT. WEB
1/16 TH RIBS
3/16 sq
3/32 x 3/8
CHEESMAN 25-100-10
1/8 sq
1/16 x 1/8
1/16 TH
3/32 x 7/16
CHEESMAN 20A-08
28 1/4
THRUST
2° RIGHT
0° DOWN
REAR BOOM
PLUGS HERE
3°
C.G. 76%
1.4 sq
.85 oz WT.
1.45 sq
27 1/2
1/16 x 1/4
3 - 1/32 x 3/32 LAM
1/16 TAB
3.7
WING — 1.10
STAB — 0.25
FUSLG+FIN — 3.40
PROP ASM 0.90
BALLAST 0.85
MOTOR ETC 1.80
TOTAL 8.30 oz
9° ASKEW
PROP: 2 BLADE FOLDER 20 ø 21" P
CUT TO DOTTED
LINES AFTER
SHAPING
UNDER-SURFACE
TOP FIN OFFSET
1/8" RIGHT
3 - 1/32 x 3/32 LAMS
NORMAL WIRE ASSEMBLY 16 SWG
18.4
1964 WAKEFIELD
F.H. BOXALL
ENGLAND



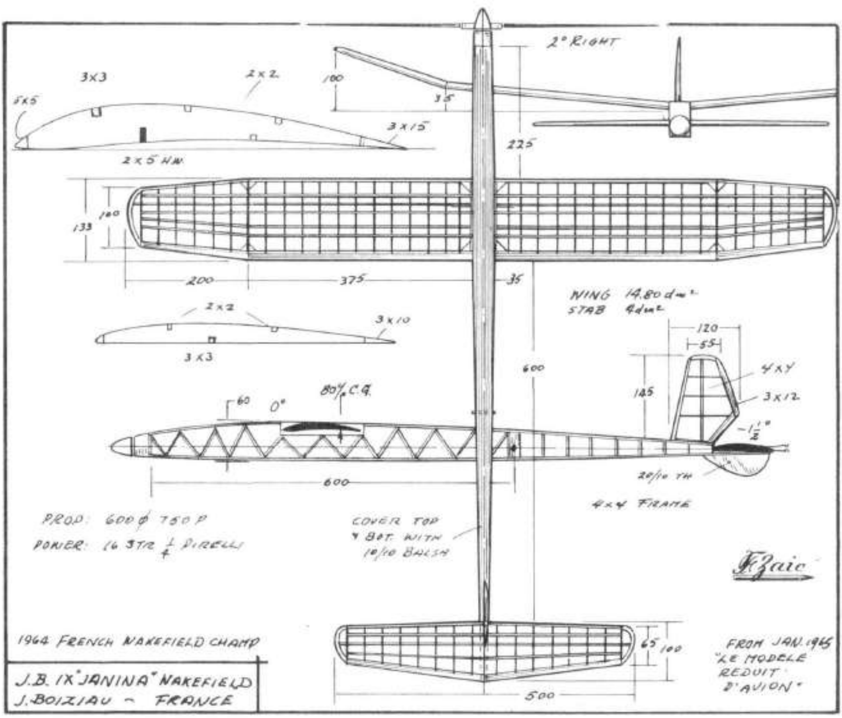
6x6
2x2
10x3
10/10
120
30
5° RIGHT
TURB.
5x2 HD. WD.
15/10
10x10
180
125
250
390
PROP: 600 ø 660 P
POWER: 20 STR - 390 LONG
6/35 PIRELLI
3 1/2°
80% C.G.
65
140
35 ø
625
0°
3° DOWN
475
90
200
500
80
OIZORAR II WAKEFIELD
MARC CHEURLOT — FRANCE
FROM FEB. 1963
"MODELE MAGAZINE"


94
4x4
2x2
2.5x2.5
2ϕ
20x4
110
10
275
35ϕ
40x55
130
225
350
PROP: 600 ϕ 600P.
POWER: 12 STR 1/4 PIRELLI
680 → 720 TURNS
120
70
550
30/10
130
70% C.G
50
3½°
+1°
690
F. Zaic
180 x 7 + 210 + 213
90
WAKE 61" 1963 FRENCH CHAMP
JACQUES PETIOT — FRANCE
FROM JAN. 1964
LE MODELE
REDUIT D'AVION
450


3x3
8/10
20x3
115
PROP: 580ϕ 800P
POWER: 16 STR 1/4 PIRELLI
GOTT 417 MOD
3x3
3x3 HW
6x2
15/10
32x3
260
25
130
90
265
690
100
68% C.G.
+3°
570
38ϕ
70
130
0°
570
3x3
3x2
TIME: 180, 180, 166, 180, 170, 180, 165
1962 FRENCH WAKEFIELD CHAMP
"IRONIC" WAKEFIELD
M. CARLES FRANCE
FROM JAN 1963
"LE MODELE
REDUIT D'AVION"
90
470
F. Zaic



95
BENEDEK 6556 b
WING & STAB
— WING —
8×8
15/10
20×5
2° RIGHT
130
10
47
35
132
340
250
309
3°
53
2°
507
12
+1°
32φ
24
520
130
105
WING — 64 g.
STAB — 18
FSLG — 60
PROP. ETC. - 35
PROP: 610φ 600P
550
90
FROM
FEB. 1962 "LE MODELE
REDUIT D'AVION"
WAKEFIELD
P. ARABEYRE
FRANCE



2° RIGHT
3×3
2×2
5×5
100
35
3×15
2×5 H.W.
225
133
100
200
375
35
WING 14.80 dm²
STAB 4 dm²
2×2
3×10
3×3
120
55
600
145
4×4
3×12
60
0°
80% C.G.
$-1\frac{1}{2}°$
600
20/10 TH
4×4 FRAME
PROP: 600φ 750P
POWER: 16 STR. $\frac{1}{4}$ PIRELLI
COVER TOP
& BOT. WITH
10/10 BALSA
1964 FRENCH WAKEFIELD CHAMP
65
100
500
FROM JAN. 1965
"LE MODELE
REDUIT
D'AVION"
J.B. IX "JANINA" WAKEFIELD
J. BOIZIAU — FRANCE

"FLAP JACK" WAKEFIELD

Clarence Mather San Diego, Calif.

A competitive free-flight model needs a maximum altitude climb and a minimum sink-rate glide. It seems unlikely that the airfoils and decalage should be the same for both requirements. However, many contemporary models do well with fixed surfaces. But some excellent power models utilize variable incidence stabs and Henry Cole flew a flapped wing gas job of high performance.

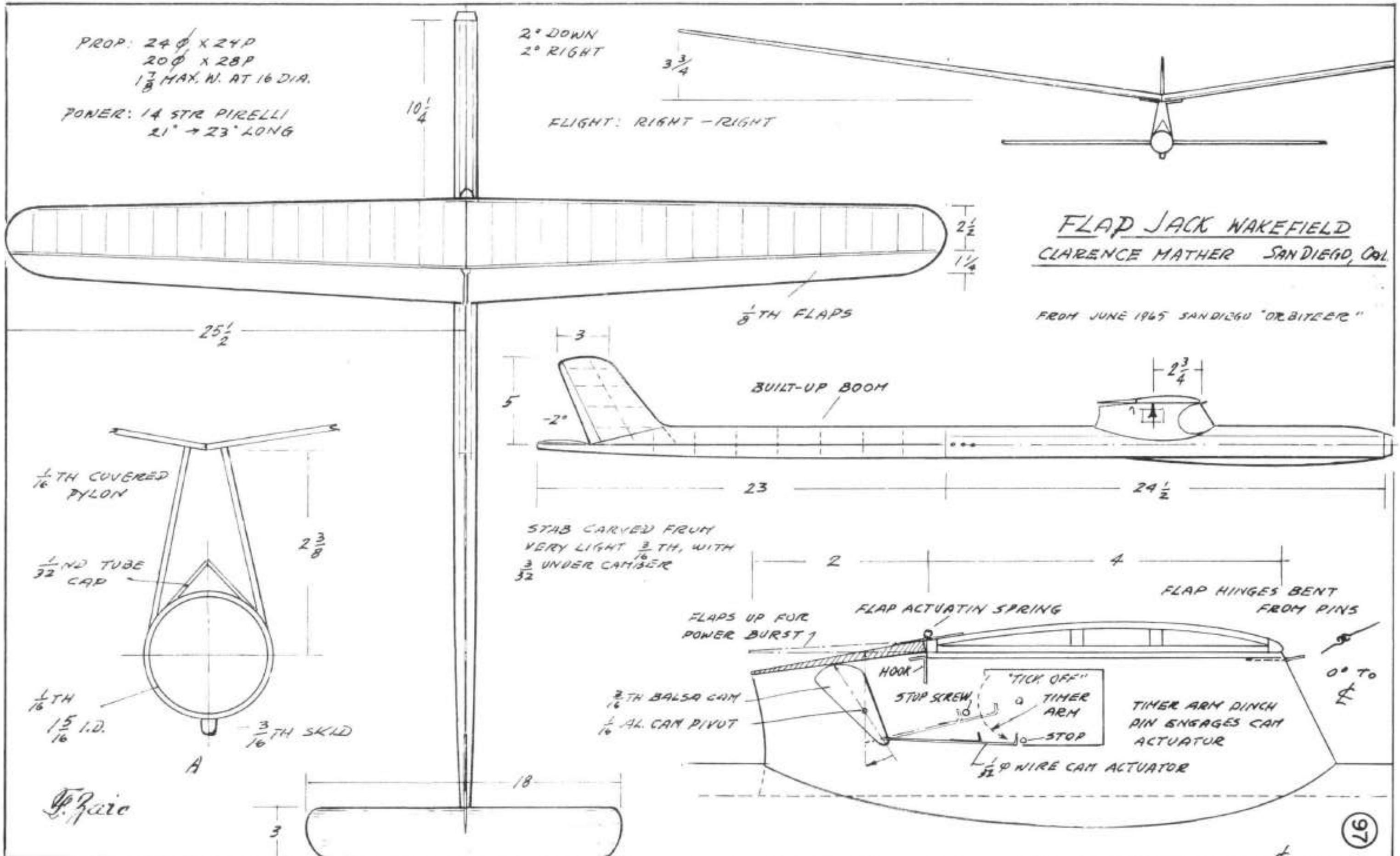
A rubber powered model has great torque at launch and expends much of its stored energy during the first part of the prop run. That fact, together with the "javelin" launches now used, suggested that a Wakefield model should have very low drag during the power burst and then assume a high lift profile for the rest of the flight.

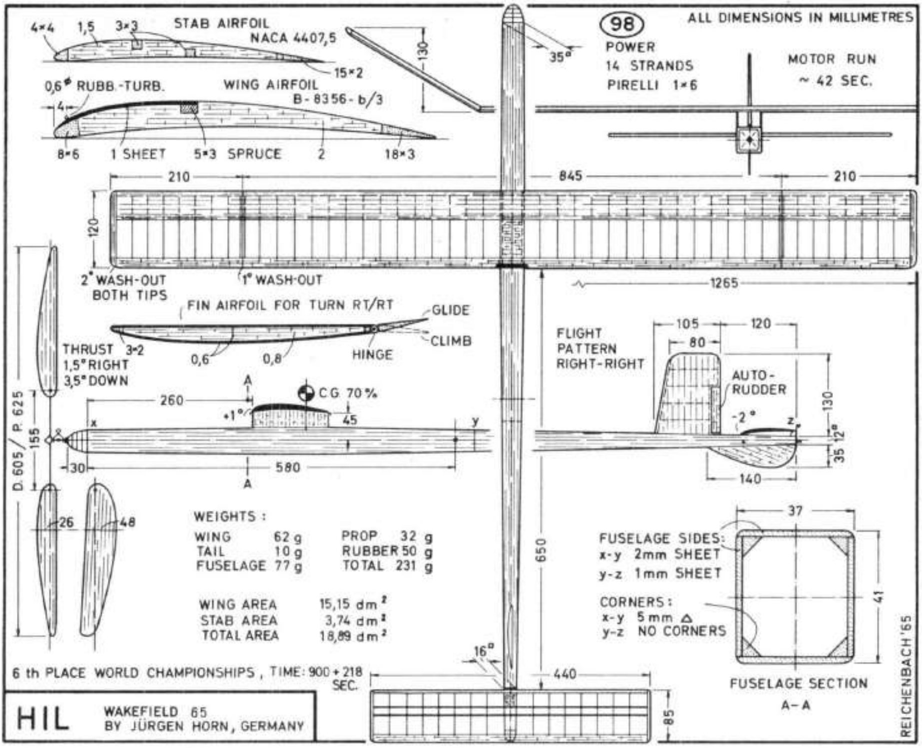
Flap Jack was built to apply that principle. At launch, the flaps are up, giving the wing a flat-bottom, five-percent airfoil, set parallel to the fuselage. The stab has a minus two degrees incidence which is enough to keep the nose up. As the torque decreases, the model would slow down and stop climbing, but the pre-set timer lowers the flaps giving a higher lift airfoil and more decalage. Thus, hopefully, the model continues climbing steeply and then glides well.

Now, however, more variables have been introduced to the trimming process. In addition to the usual center of gravity, decalage and thrust adjustments, there is right glide fly angle, left power flap angle, time of flap lowering, etc. Such a machine can tax the capabilities of a computer! However, the ship was trimmed without a great deal of trouble and gave good performance although it was not certain that it had an advantage over conventional models. Neither is it certain that the best flap angle or prop pitch have been found. Originally, rubber purchased a number of years age was used, and the flaps were lowered about ten seconds after launch. The climb was steep throughout the prop run.

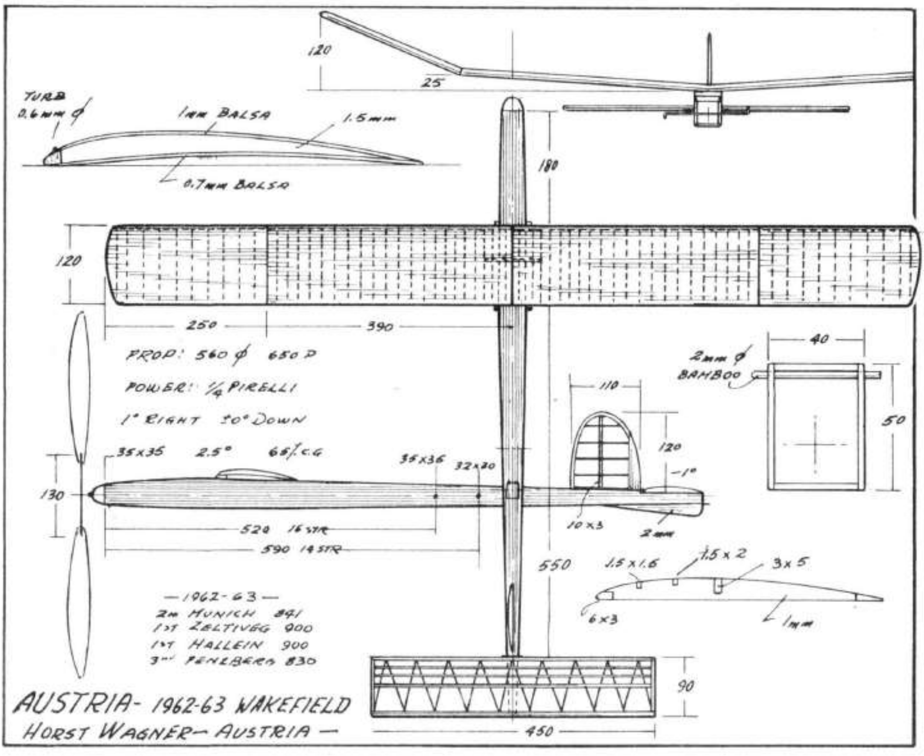
Recently, rubber from a newer batch was used with a great reduction in climb. The new rubber is thinner and also seems to lack torque. The model still does fairly well on the power burst, but climbs little or none thereafter. A smaller diameter higher pitch prop is being tried in the thought that more forward speed is necessary for a continued climb. It is also planned to lower the flaps farther since the airfoil is still quite thin even with the flaps down.

R. C. balsa is used for the wing construction and seems to give it adequate strength. A previous wing had solid ribs and surface stringers. It developed a warp and finally was destroyed by a car. Another wing was wrecked when I caught a tip with my right hand during a windy-weather launch at a Chicagoland contest. Once the flaps were lowered too early and the model looped over and broke off both prop blades. Another time, the flap timer was not released and the model cruised around that level, then glided in a shallow dive — much less severe than expected!

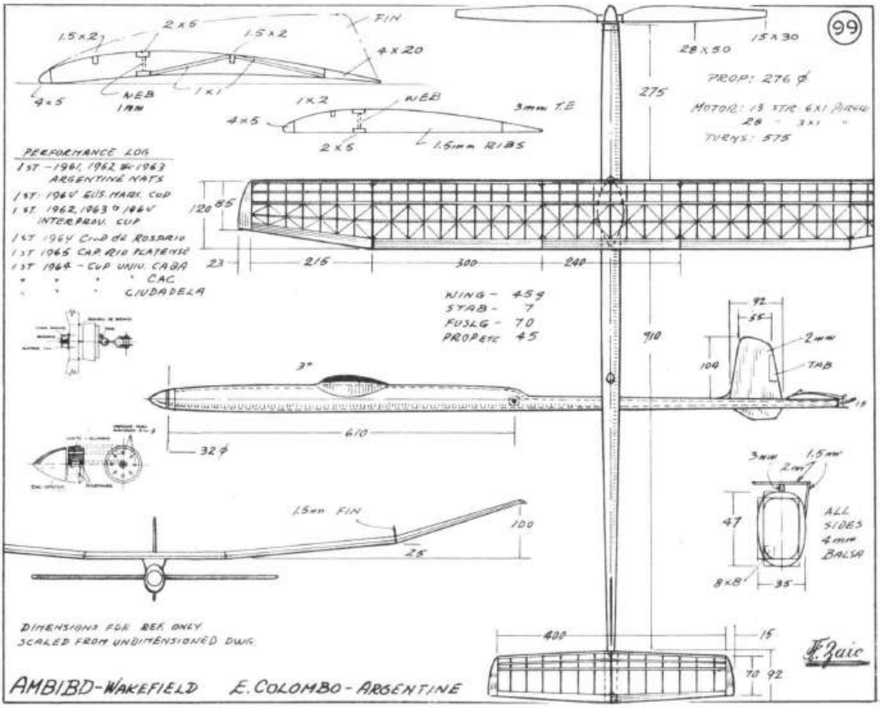

FLAP JACK WAKEFIELD
CLARENCE MATHER SAN DIEGO, CAL.
FROM JUNE 1965 SAN DIEGO "ORBITEER"
PROP: 24 Ø X 24 P
20 Ø X 28 P
1 3/8 MAX. W. AT 16 DIA.
POWER: 14 STR PIRELLI
21" → 23" LONG
2° DOWN
2° RIGHT
FLIGHT: RIGHT - RIGHT
3 3/4
10 1/4
2 1/2
1 1/4
25 1/2
1/8 TH FLAPS
3
5
-2°
BUILT-UP BOOM
2 3/4
23
24 1/2
STAB CARVED FROM VERY LIGHT 3/16 TH, WITH 3/32 UNDER CAMBER
1/16 TH COVERED PYLON
1/32 ND TUBE CAP
2 3/8
1/16 TH
1 5/16 I.D.
3/16 TH SKID
A
18
3
2
4
FLAP HINGES BENT FROM PINS
FLAPS UP FOR POWER BURST
FLAP ACTUATIN SPRING
HOOK
"TICK OFF"
STOP SCREW
TIMER ARM
STOP
3/16 TH BALSA CAM
1/16 AL. CAM PIVOT
1/32 Ø WIRE CAM ACTUATOR
TIMER ARM PINCH PIN ENGAGES CAM ACTUATOR
0° TO ℄
℄
97

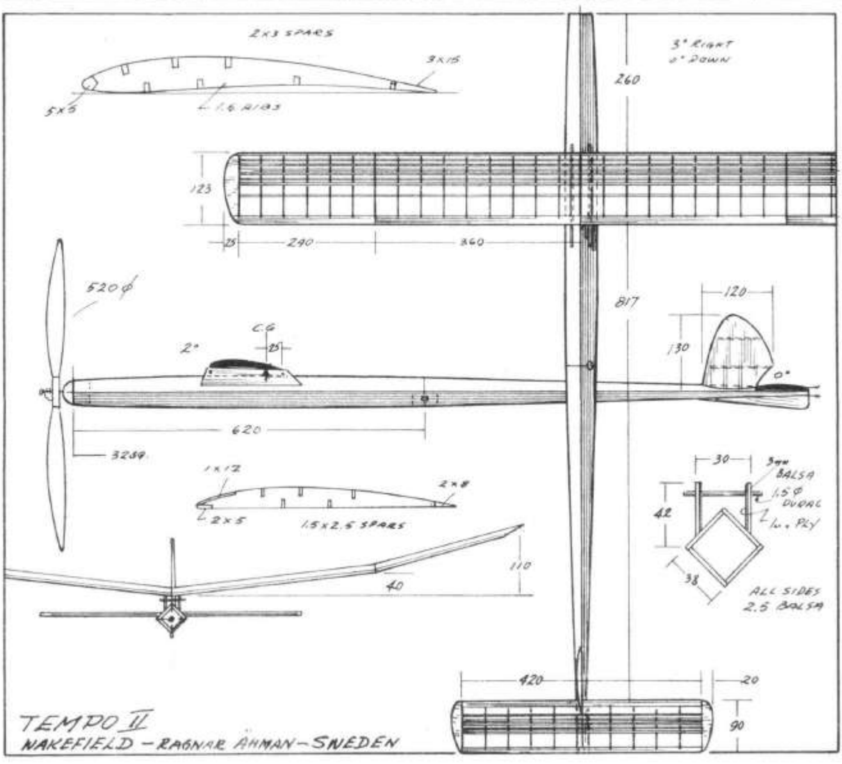


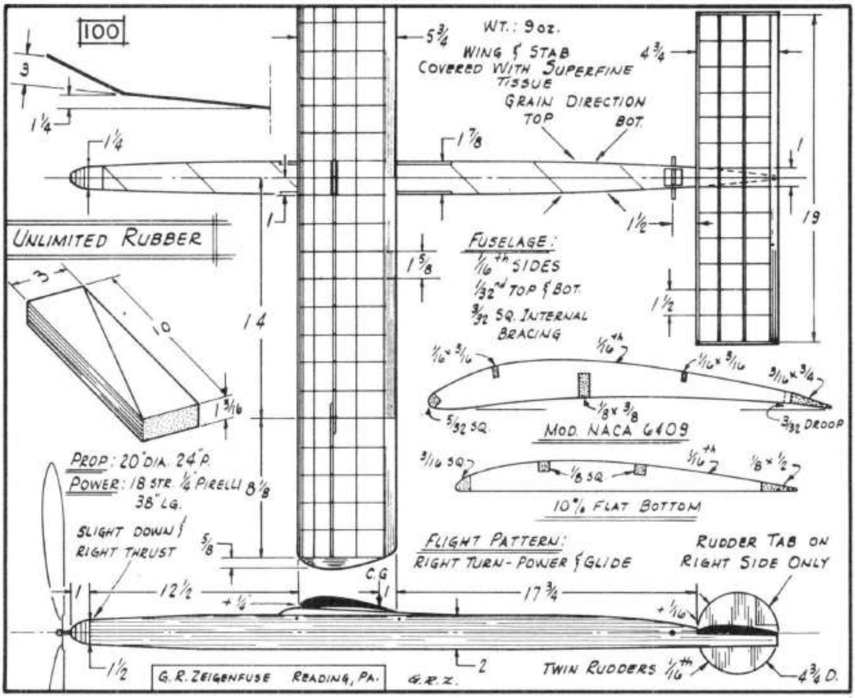
ALL DIMENSIONS IN MILLIMETRES
98
POWER
14 STRANDS
PIRELLI 1×6
MOTOR RUN
~ 42 SEC.
STAB AIRFOIL
NACA 4407,5
4×4 1,5 3×3
15×2
130
35°
0,6∅ RUBB.-TURB.
WING AIRFOIL
B-8356-b/3
8×6 1 SHEET 5×3 SPRUCE 2 18×3
210
845
210
120
2° WASH-OUT
BOTH TIPS
1° WASH-OUT
1265
FIN AIRFOIL FOR TURN RT/RT
GLIDE
CLIMB
HINGE
0,6 0,8
THRUST 3×2
1,5° RIGHT
3,5° DOWN
FLIGHT
PATTERN
RIGHT-RIGHT
105 120
80
AUTO-
RUDDER
-2°
130
12°
35
140
D. 605 / P. 625
155
26
48
260
+1°
C.G. 70%
45
30
580
A
A
x
y
z
WEIGHTS:
WING 62 g
TAIL 10 g
FUSELAGE 77 g
PROP 32 g
RUBBER 50 g
TOTAL 231 g
WING AREA 15,15 dm²
STAB AREA 3,74 dm²
TOTAL AREA 18,89 dm²
650
37
FUSELAGE SIDES:
x-y 2mm SHEET
y-z 1mm SHEET
CORNERS:
x-y 5 mm △
y-z NO CORNERS
41
FUSELAGE SECTION
A–A
16°
440
85
REICHENBACH '65
6 th PLACE WORLD CHAMPIONSHIPS, TIME: 900 + 218 SEC.
HIL
WAKEFIELD 65
BY JÜRGEN HORN, GERMANY



120
25
TURB
0.6 mm ∅
1mm BALSA
1.5mm
0.7mm BALSA
180
120
250
390
PROP: 560 ∅ 650 P
POWER: ¼ PIRELLI
1° RIGHT 3.0° DOWN
35×35 2.5° 65% C.G
35×36 32×30
130
520 16 STR
590 14 STR
110
120
-1°
10×3
2mm
2mm ∅
BAMBOO
40
50
550
1.5×1.6
1.5×2
3×5
6×3
1mm
—1962-63—
2nd MUNICH 841
1st ZELTIVEG 900
1st HALLEIN 900
3rd PENZBERG 830
90
450
AUSTRIA- 1962-63 WAKEFIELD
HORST WAGNER— AUSTRIA —


99
1.5×2
2×5
1.5×2
FIN
4×20
4×5
WEB
1MM
1×1
1×2
WEB
4×5
2×5
1.5mm RIBS
3mm T.E
28×50
15×30
275
PROP: 276 ϕ
MOTOR: 13 STR 6×1 PIRELLI
28 - 3×1 "
TURNS: 575
PERFORMANCE LOG
1ST - 1961, 1962 & 1963
ARGENTINE NATS
1ST 1964 EUS. MARC. CUP
1ST 1962, 1963 & 1964
INTERPROV. CUP
1ST 1964 CIUD DE ROSARIO
1ST 1965 CAP. RIO PLATENSE
1ST 1964 - CUP UNIV. CABA
" " " " CAC
" " " CIUDADELA
120
85
23
215
300
240
WING - 45g
STAB - 7
FUSLG - 70
PROP ETC 45
92
55
2mm
710
104
TAB
3°
610
32 ϕ
3mm
1.5mm
2mm
47
ALL
SIDES
4mm
BALSA
8×8
35
1.5mm FIN
100
25
DIMENSIONS FOR REF. ONLY
SCALED FROM UNDIMENSIONED DWG.
400
15
70
92
F. Zaic
AMBIBD-WAKEFIELD E. COLOMBO - ARGENTINE


2×3 SPARS
3×15
5×5
1.6 RIBS
3° RIGHT
0° DOWN
260
123
25
240
360
520 ϕ
817
120
C.G
25
2°
130
0°
620
3289.
1×12
2×8
2×5
1.5×2.5 SPARS
30
3mm
BALSA
1.5 ϕ
DURAL
1mm PLY
42
38
110
40
ALL SIDES
2.5 BALSA
420
20
90
TEMPO II
WAKEFIELD - RAGNAR ÅHMAN - SWEDEN

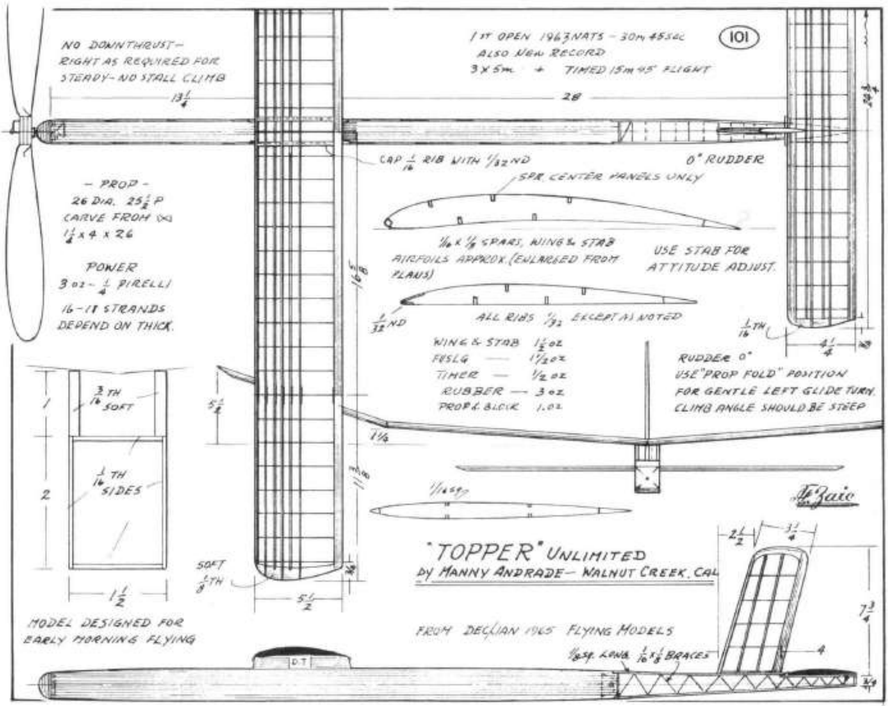


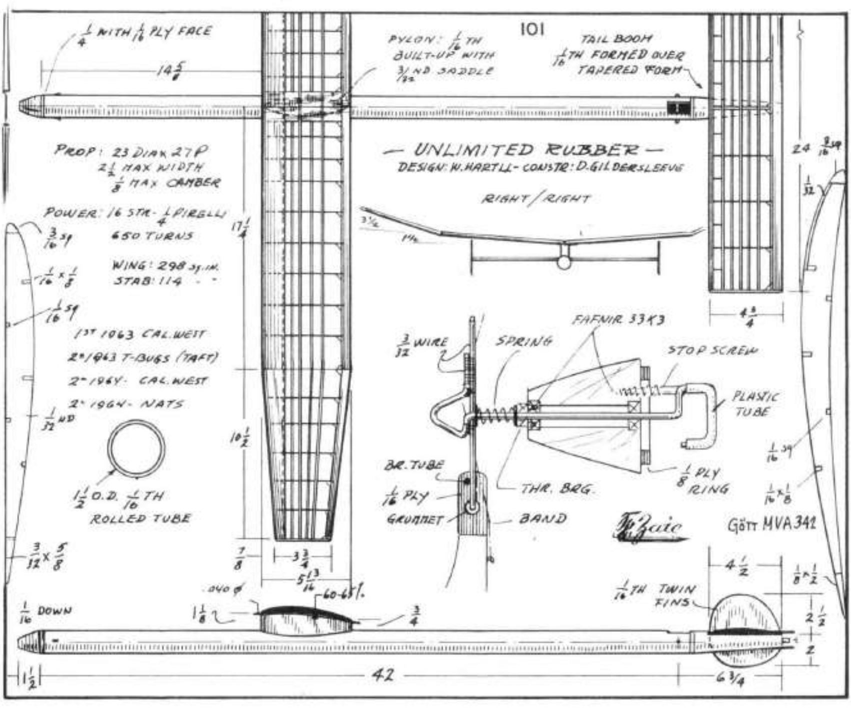
RUBBER MODEL is just what it appears to be, a simple bare essentials model. Its contest record is the best of any model I have ever built. This 250 sq. incher is the largest of this series and oldest. It was first built as a more fancy type model to wow the boys at the 1957 Nats. It flopped badly at local meets and never got there. I revamped it in 1958, actually simplified it, the only things remaining were the flying surfaces.

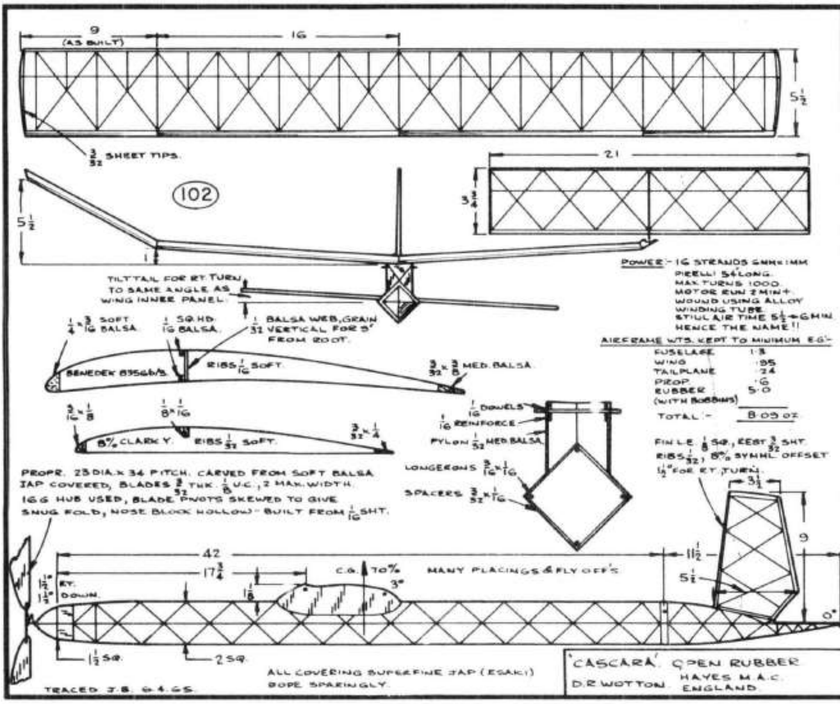
After that it was one 1st place after another, with an occasional 2nd thrown in. Still air time on 600 turns was an amazing 5:00 to 5:30 and the time went up in the wind. By the time of the '61 Nats it was a bit limp, but still capable of 4:30 in still air. Bad rubber (not yours) ruined me as I broke all of them on ½ winds.

The last meet flown was in 1962, but by this time the folding mechanism was too worn to be dependable. I had three successive bad folds and stalled all the way down on every flight. The height reached was so great that I was able to do 3 minutes or more on each flight. I took first place, but felt guilty and finally retired the plane.

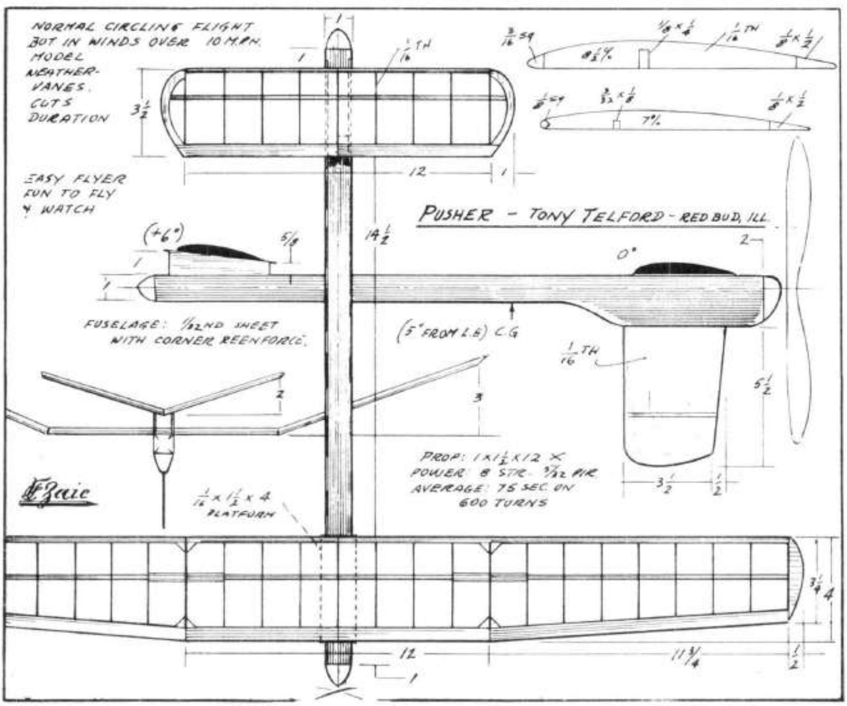
This plane was designed to take advantage of Eastern weather. It has a short (45-50 seconds) but powerful motor run to punch through ground turbulence and it bounces well in the wind. It literally flies rings around these modern, elongated, wakefield inspired rubber models.


101
NO DOWNTHRUST— RIGHT AS REQUIRED FOR STEADY—NO STALL CLIMB
1ST OPEN 1963 NATS – 30m 45sec ALSO NEW RECORD 3 X 5m + TIMED 15m 45" FLIGHT
CAP 1/16 RIB WITH 1/32 ND
0° RUDDER
SPR. CENTER PANELS ONLY
— PROP — 26 DIA. 25 1/2 P CARVE FROM ∞ 1 1/4 X 4 X 26
POWER 3 oz – 1/4 PIRELLI 16–18 STRANDS DEPEND ON THICK.
1/16 X 1/8 SPARS, WING & STAB AIRFOILS APPROX. (ENLARGED FROM PLANS)
USE STAB FOR ATTITUDE ADJUST.
ALL RIBS 1/32 EXCEPT AS NOTED
WING & STAB 1 1/2 oz
FUSLG — 1 1/2 oz
TIMER — 1/2 oz
RUBBER — 3 oz
PROP & BLCK 1. oz
RUDDER 0° USE "PROP FOLD" POSITION FOR GENTLE LEFT GLIDE TURN. CLIMB ANGLE SHOULD BE STEEP
3/16 TH SOFT
1/16 TH SIDES
SOFT 1/8 TH
"TOPPER" UNLIMITED
by MANNY ANDRADE— WALNUT CREEK, CAL
MODEL DESIGNED FOR EARLY MORNING FLYING
FROM DEC/JAN 1965 FLYING MODELS
1/8 sq. LONG. 1/16 X 1/8 BRACES
D.T.
Zaic

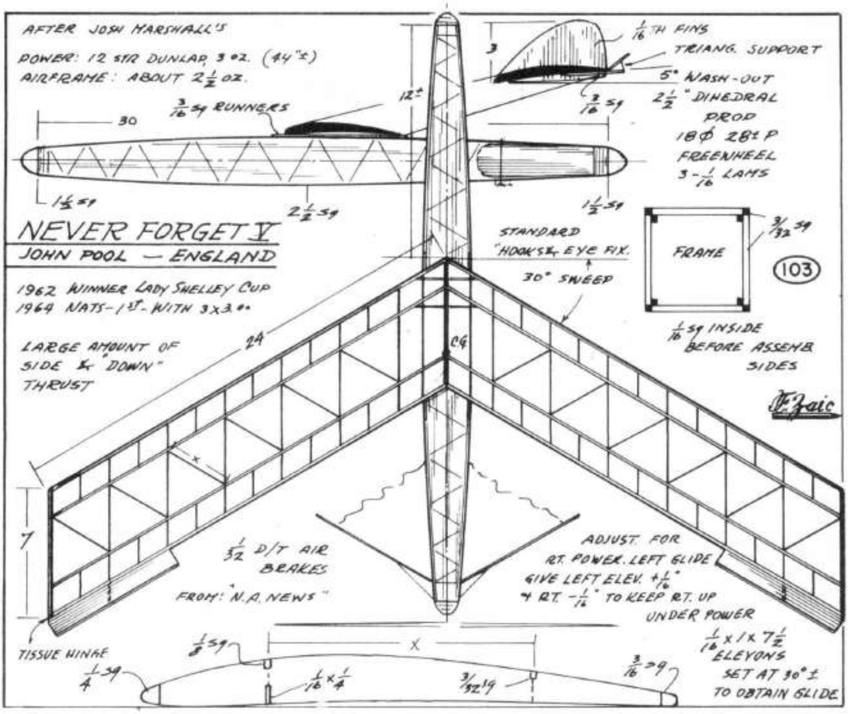

101
1/4 WITH 1/16 PLY FACE
PYLON: 1/16 TH BUILT-UP WITH 3/32 ND SADDLE
TAIL BOOM 1/16 TH FORMED OVER TAPERED FORM
PROP: 23 DIA X 27 P 2 1/2 MAX WIDTH 1/8 MAX CAMBER
POWER: 16 STR- 1/4 PIRELLI 650 TURNS
WING: 298 sq. in. STAB: 114
1ST 1963 CAL. WEST
2ND 1963 T-BUGS (TAFT)
2ND 1964 - CAL. WEST
2ND 1964 - NATS
— UNLIMITED RUBBER —
DESIGN: W. HARTILL – CONSTR: D. GILDERSLEEVE
RIGHT / RIGHT
FAFNIR 33K3
3/32 WIRE
SPRING
STOP SCREW
PLASTIC TUBE
BR. TUBE
1/16 PLY
GRUMMET
THR. BRG.
BAND
1/8 PLY RING
1 1/2 O.D. 1/16 TH ROLLED TUBE
1/16 TH TWIN FINS
1/16 DOWN
.040 ø
60-65%
Zaic
Gött MVA 342

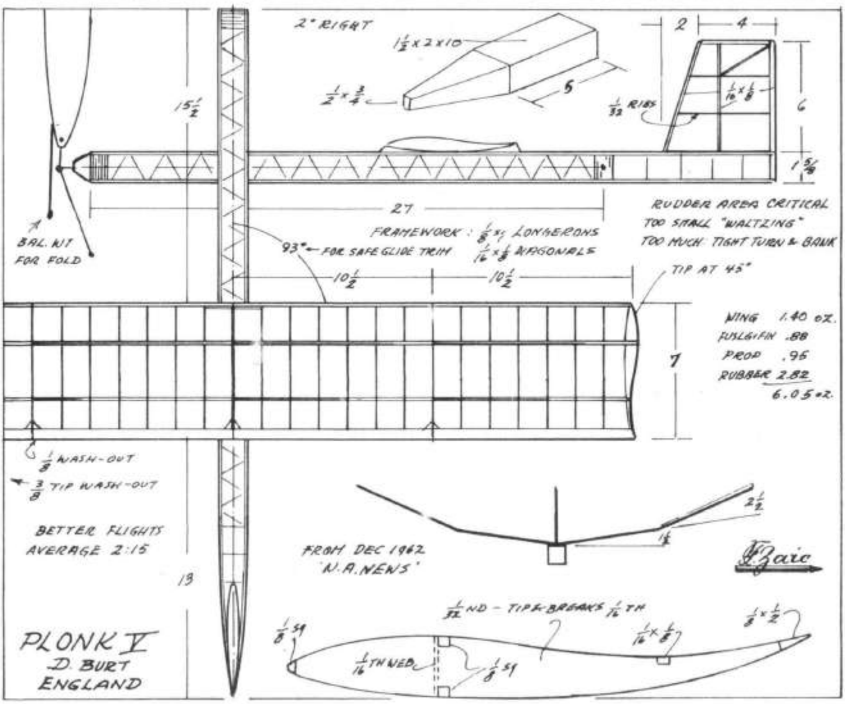


9 (AS BUILT)
16
3/32 SHEET TIPS.
5 1/2
21
3 3/4
(102)
5 1/2
TILT TAIL FOR RT. TURN TO SAME ANGLE AS WING INNER PANEL.
1/4 x 3/16 SOFT BALSA.
1/16 SQ. HD. BALSA.
1/32 BALSA WEB, GRAIN VERTICAL FOR 5" FROM ROOT.
BENEDEK 8356b/B.
RIBS 1/16 SOFT.
3/32 x 3/8 MED. BALSA.
3/16 x 1/8
1/8 x 1/16
8% CLARK Y.
RIBS 1/32 SOFT.
3/32 x 1/4
POWER:- 16 STRANDS 6MM x 1MM PIRELLI 54" LONG. MAX. TURNS 1000. MOTOR RUN 2 MIN+. WOUND USING ALLOY WINDING TUBE. STILL AIR TIME 5 1/2 → 6 MIN. HENCE THE NAME!!
AIRFRAME WTS. KEPT TO MINIMUM E.G.:-
FUSELAGE 1·3
WING ·95
TAILPLANE ·24
PROP. ·6
RUBBER (WITH BOBBINS) 5·0
TOTAL:- 8·09 oz.
1/16 DOWELS
1/16 REINFORCE
PYLON 1/32 MED BALSA
LONGERONS 3/16 x 1/16
SPACERS 3/32 x 1/16
FIN L.E. 1/8 SQ., REST 3/32 SHT. RIBS 1/32, 8% SYMML. OFFSET 1/2" FOR RT. TURN.
3 1/2
9
PROPR. 23 DIA. x 34 PITCH. CARVED FROM SOFT BALSA. JAP COVERED, BLADES 3/32 THK. 1/8 U.C., 2 MAX. WIDTH. 16G HUB USED, BLADE PIVOTS SKEWED TO GIVE SNUG FOLD, NOSE BLOCK HOLLOW - BUILT FROM 1/16 SHT.
42
17 3/4
C.G. 70%
3"
MANY PLACINGS & FLY OFF'S.
11 1/2
5 1/2
1 1/2" RT.
1 1/2" DOWN.
1 1/8
0°
1 1/2 SQ.
2 SQ.
ALL COVERING SUPERFINE JAP (ESAKI) DOPE SPARINGLY.
TRACED J.B. 6.4.65.
'CASCARA'. OPEN RUBBER
D.R. WOTTON. HAYES M.A.C. ENGLAND.



NORMAL CIRCLING FLIGHT BUT IN WINDS OVER 10 M.P.H. MODEL WEATHER-VANES. CUTS DURATION
EASY FLYER FUN TO FLY & WATCH
1
1/16 TH
3 1/2
12
1
3/16 SQ
1/8 x 1/4
1/16 TH
1/8 x 1/2
8 1/2 %
1/8 SQ
3/32 x 1/8
7%
1/8 x 1/2
PUSHER - TONY TELFORD - RED BUD, ILL.
(+6°)
5/8
14 1/2
0°
2
1
FUSELAGE: 1/32ND SHEET WITH CORNER REENFORCE.
(5" FROM L.E.) C.G.
1/16 TH
5 1/2
2
3
PROP: 1 x 1 1/2 x 12 x
POWER: 8 STR. 3/32 AIR
AVERAGE: 75 SEC. ON 600 TURNS
3 1/2
1/2
1/16 x 1 1/2 x 4 PLATFORM
3 1/4
4
12
11 3/4
1/2
1


AFTER JOSH MARSHALL'S
POWER: 12 STR DUNLAP, 3 OZ. (44" ±)
AIRFRAME: ABOUT 2½ OZ.
3/16 SQ RUNNERS
30
1½ SQ
2½ SQ
NEVER FORGET V
JOHN POOL — ENGLAND
1962 WINNER LADY SHELLEY CUP
1964 NATS-1ST- WITH 3x3.0
LARGE AMOUNT OF SIDE & "DOWN" THRUST
12±
1/16 TH FINS
3
TRIANG. SUPPORT
3/16 SQ
5° WASH-OUT
2½" DIHEDRAL
PROP
18Ø 28± P
FREEWHEEL
3-1/16 LAMS
1½ SQ
STANDARD "HOOK SE EYE FIX."
30° SWEEP
FRAME
3/32 SQ
103
1/16 SQ INSIDE BEFORE ASSEMB. SIDES
F. Zaic
24
CG
x
7
3/32 D/T AIR BRAKES
FROM: "N.A. NEWS"
ADJUST FOR RT. POWER, LEFT GLIDE
GIVE LEFT ELEV. +1/16"
& RT. -1/16" TO KEEP RT. UP UNDER POWER
1/16 x 1 x 7½ ELEVONS
SET AT 30° ± TO OBTAIN GLIDE
TISSUE HINGE
1/8 SQ
X
1/4 SQ
1/16 x 1/4
3/32 SQ
3/16 SQ


2° RIGHT
1½ x 2 x 10
½ x ¾
5
15½
2
4
1/32 RIBS
1/16 x 1/8
6
1 5/8
27
RUDDER AREA CRITICAL
TOO SMALL "WALTZING"
TOO MUCH: TIGHT TURN & BANK
BAL. WT FOR FOLD
FRAMEWORK: 1/8 SQ LONGERONS
1/16 x 1/8 DIAGONALS
93° — FOR SAFE GLIDE TRIM
10½
10½
TIP AT 45°
WING 1.40 OZ.
FUSL&FIN .88
PROP .96
RUBBER 2.82
6.05 OZ.
7
1/8 WASH-OUT
3/8 TIP WASH-OUT
BETTER FLIGHTS AVERAGE 2:15
2½
1½
FROM DEC 1962 "N.A. NEWS"
F. Zaic
13
1/32 ND - TIP & BREAKS 1/16 TH
1/8 SQ
1/16 x 1/8
1/8 x 1/2
1/16 TH WEB
1/8 SQ
PLONK V
D. BURT
ENGLAND

« What is it ? « Wintercupers USA »

« Mais qu'est-donc que la « coupe d'hiver ? » se demande Dan Hodges de Sapulpa (Oklahoma) dans le bulletin Tulsa Glue Dobler Newletter. Et d'expliquer à ses lecteurs qu'un « winter cup » est un 1/2 A wakefield (ah ! des dimensions !) qu'il est popularisé en France depuis plus de 20 ans et que bien des pays d'Europe tels la Finlande, la Tchécoslovaquie, l'Espagne, l'Italie et bien d'autres l'ont inscrit à leurs compétitions sans oublier l'Angleterre où la formule fait rage actuellement.

Et de se demander l'intérêt de son introduction aux U.S.A.

L'intérêt Dan Hodges le découvre dans les dimensions et les limitations qui rendent la formule bien plus agréable aux amateurs que son sophistiqué grand frère, le Wakefield. Et de ce nouveau sang se manifesteront sans doute des vocations pour ce « grand-papa » de l'Aéromodélisme qu'est le moteur à caoutchouc et qui lui rendront son lustre.

En illustration voici trois modèles Made in U.S.A.

Le premier, l'appareil de Dan Hodges. C'est un modèle à fuselage carré sur champ, ---- ---- MODELE MAGAZINE.

What is this thing called "Winter Cup"? Well it is to the free flight world what the Bassanova is to light-fantastic-trippers — a "new beat". The Winter Cup model is basically a 1/2A Wakefield — that is, limited rubber powered ship of smaller size, limited rubber weight and much less restrictive rules than its sophisticated big brother, the Wakefielder. This event was popularized in France some twenty or more years ago and enjoys great success in that country. In recent years Finland, Czechoslovakia, Italy, Spain and other countries have added this event to their national competition calendars. Winter Cup models are becoming the rage in England, too. But why, you might ask, do we need another event in this country? What would modeling be (or anything else for that matter) without a fresh approach occasionally, a new stimulus to challenge our abilities? This event is most deserving a chance for national recognition in the U.S. It would be a shot in the arm to the Granddaddy of Modeling — the rubber powered model. After all, it was from this one event that all of this conglomeration of power patterns, pressure tanks, speed pans, escapements and superhets grew. — Dan Hodges, Tulsa Glue Dobbers Newsletter, March, 1963.

COUPE d'HIVER RUBBER CLASS

Charles Sotich — Chicago, Ill.

Today there aren't very many young modelers who compete in Wakefield and Unlimited Rubber events. To have a good chance of doing well in Unlimited Rubber requires a model of 200 to 300 square inches of wing area with four ounces of rubber turning a

20- to 24-inch diameter prop. Building a big, light weight but strong structure and having the model nearly climb out of sight under power is what offers most of the challenge to those who compete in this event. It is probably these two factors along with carving a propeller which make up the mental blocks which keep other modelers from trying this event. Except for making the prop and nose unit, a rubber model requires no skills different from those involved in making a Half-A gas model (so I've been told).

The French originated (Maurice Bayet, Editor of Le Modele Reduit d'Avion, in 1944) the Coupe d'Hiver (Winter Cup) event in a class for rubber models that isn't so tough on the newcomers. These models are relatively small and easy to build and fly. A typical model has a wing area of about 150 square inches with a span of 30 to 40 inches, a fuselage length of about 30 inches and a propeller 15 inches in diameter. The motor used to power these models is limited to just 10 grams of rubber. This is about a 64-inch length of 1/4 x 1/24 Pirelli rubber. This can be .... made into a four-strand motor 16 inches long, or six strands 10⅔ inches long, or eight strands 8 inches long. A motor for a Winter Cup model looks as though it would be just about right for holding the wings on a Class B or C free-flight gas model. Anyone who has flown a rubber model of Wakefield size or larger will realize that this isn't much power. Winding a motor of this size to capacity would not even be a problem to a 90-pound weakling.

There should be no trouble interpreting the rules or deciding whether or not a model meets the requirements for this event. The rules are very simple:

1. Maximum rubber allowed: 10 grams (0.352 ounces)
2. Minimum model weight without motor: 70 grams (2.46 ounces)
3. Fuselage must have a cross-section area of 20 sq. cm. (3.1 sq. in.)
4. All flights must Rise-Off-Ground

A two-minute flight limit is used and the total time for three flights determines the winner.

These rules are interesting and different in several respects from other rubber events. There are no restrictions as to wing areas or spans. A model can be as big or as small as you want to make it. Only 10 grams of rubber can be used to power 80 grams of airplane. This is only 12½ percent of the total weight. Wakefield motors which weigh 50 grams are 21.7 percent of the 230 gram total weight. About 50 percent of the weight of most unlimited rubber models is due to the weight of the motor. This should make it clear that there is no power to spare for a Coupe d'Hiver and the altitude reached isn't going to be very high compared to the other type of rubber models.

By keeping to the minimum total weight of 80 grams (2.82 ounces) and with a typical wing having an area of 150 square inches, a wing loading of less than 2 ounces per 100 square inches results. This is half the wing loading of Wakefield models, so the Coupe d'Hiver models will be slower gliding. This makes them easier to adjust and less susceptible to damage. The low wing loadings also result in floating glides. If there is any lift around a Winter Cup model will ride it. If the thermal is strong you better watch out since the model could have trouble dethermalizing. Although flights of two minutes have been made, they don't occur very regularly and it takes a good model to get into some lift. The small quantity of rubber allowed for power not only makes for an event that is easy to fly but one that is very challenging too. These models just aren't able to climb very high under power. It is extremely unlikely that they can even get 100 feet high without thermal help. Since it is usually very difficult to get thermals at such a low altitude much of the luck element is removed from the competition.

With many parts of the country not having large flying sites available, flying events with five-minute maximum flight limits isn't practical. While the flight limit can be reduced and the motor runs of gas engines can be cut down, how do you go about reducing the performance of unlimited rubber models? The Coupe d'Hiver models don't need to have their performance cut because this was done by the rule limiting their motors to 10 grams. It is rather obvious that smaller fields can be used for flying when you are only going after a two-minute max. The shorter flights also makes it much easier to retrieve the models and the chances of loosing a model are cut down.

The Dwarf Dip II is rather typical of Coupe d'Hiver models. It has a long body with the motor way up in the front. The front of the body is made extra strong to withstand the breaking of the motors that are wound past their turns capacity. (If a motor isn't broken occasionally it means that the winder isn't trying to get in the maximum number of turns.) The tail end of the body is kept light to save weight and improve stability. Sheet balsa is used in the body both for strength and to simplify construction, as well as to make it easier to handle.

The wing and stab were designed to be simple to make, warp resistant and light. The stab has a constant chord for simplicity, diagonal ribs to resist warping and sliced ribs for lightness. The wing is more of a problem. It is desirable to use a thinner airfoil than for regular rubber models because the thicker airfoils lose some of their effectiveness as the flying speed and wing chord are reduced. The airfoil is 6 percent thick and has a maximum mean camber of 5 percent at 50 percent of the chord. The large balsa leading edge and top spruce spars have provided sufficient strength to fly in winds while still giving a light structure. The false ribs used on the wing and stab help to reduce the sagging of the tissue near the leading edge. The Vee dihedral is easier to make than tip or polydihedral, and there are fewer glued dihedral brakes where warps can develop.

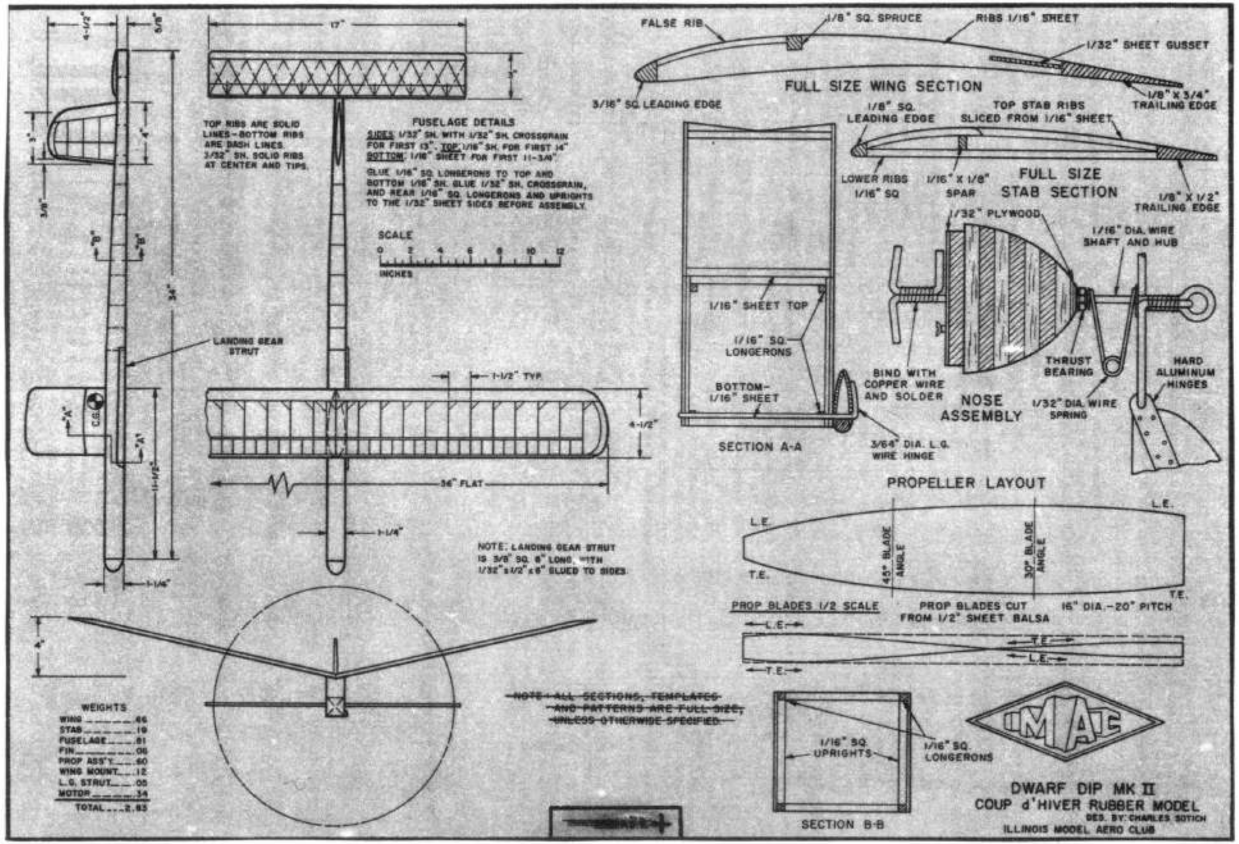
The heart of any rubber model is its propeller. The Dwarf Dip II uses a single-blade prop with a 16-inch diameter and 20-inch pitch. The original model used a two-bladed prop but the rate of climb was inadequate in the wind when using six strands of ¼-inch Pirelli rubber. The climb was improved by using an eight strand motor. The motor run, however, was cut down from nearly 30 seconds to about 15 seconds. By going to a single blade prop and a six-strand motor the prop run is increased slightly to about 20 seconds.

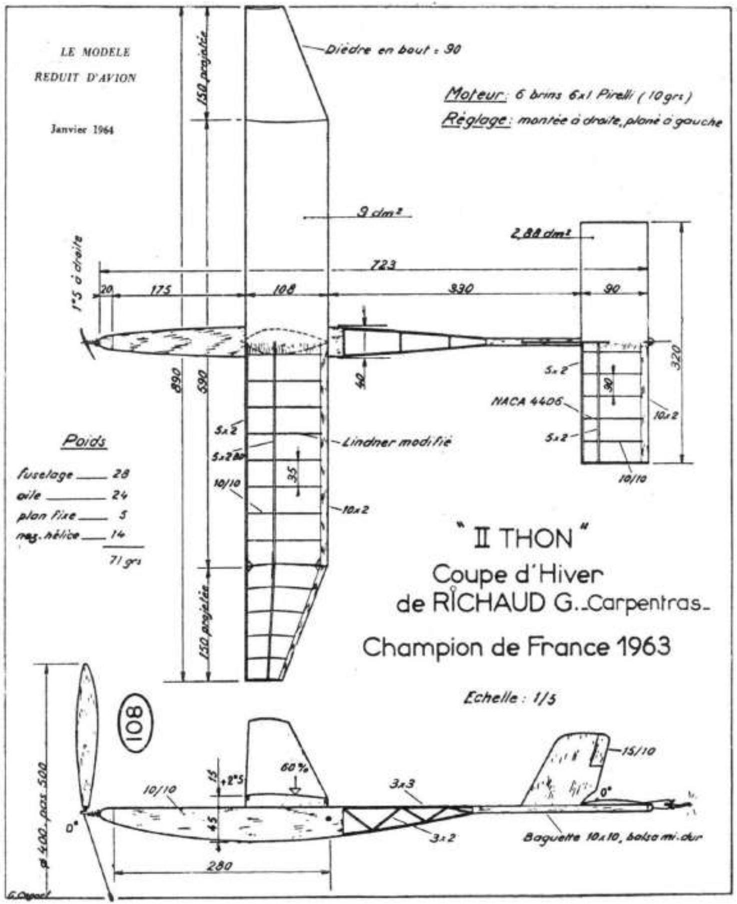
It is interesting to note that while one-bladed props are not seen very frequently on present day Wakefield or unlimited rubber models they are rather common on Coupe d'Hiver models. Newcomers to rubber flying might prefer using a single blade because there is no worry about making both blades the same, and it is easier to make a single blade fold flat against the fuselage. Care should be used to balance the propeller to minimize vibration problems. When you are working on your propeller and nose unit—if, you remember that you only have 10 grams of rubber for power—it may help you be a bit more patient and try to do the best job possible.

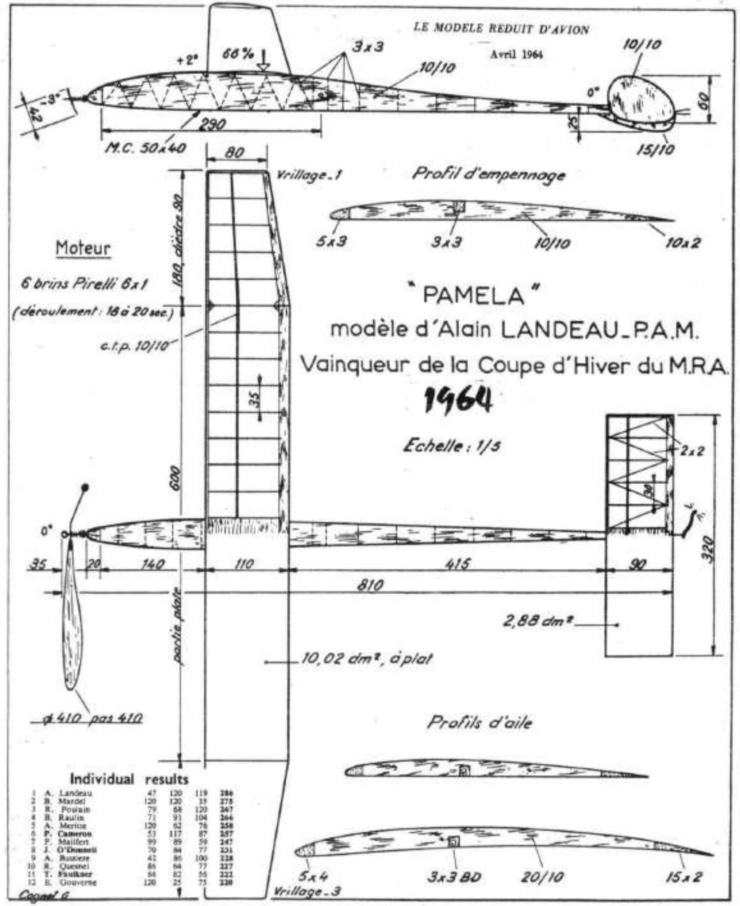
To help get the most performance out of any Coupe d'Hiver model, care should be used while building to avoid exceeding the 70 gram minimum model weight. This can be done by carefully picking out the wood for your construction and using a scale to weigh the parts as you build them. If something is too heavy it should be sanded down or made over again using lighter wood. It is sometimes handy to build a model under weight and carry some ballast while it is new, so that as it picks up weight from being repaired, the ballast can be removed without exceeding the weight rule.

For contest flying the rubber used to power these models should be weighed so that the strip of rubber weighs just over 9½ grams before it is lubricated. A number of motors should be made up at the same time before you go out to fly. If a motor breaks, a new one can be quickly substituted. It would be unwise to fly in a contest with a motor that was broken and had been retied. Too much rubber is lost in tying the ends together.

If you're one of the many modelers who started modeling with a gas model, why not take a step forward and see if *you* can build a rubber model.

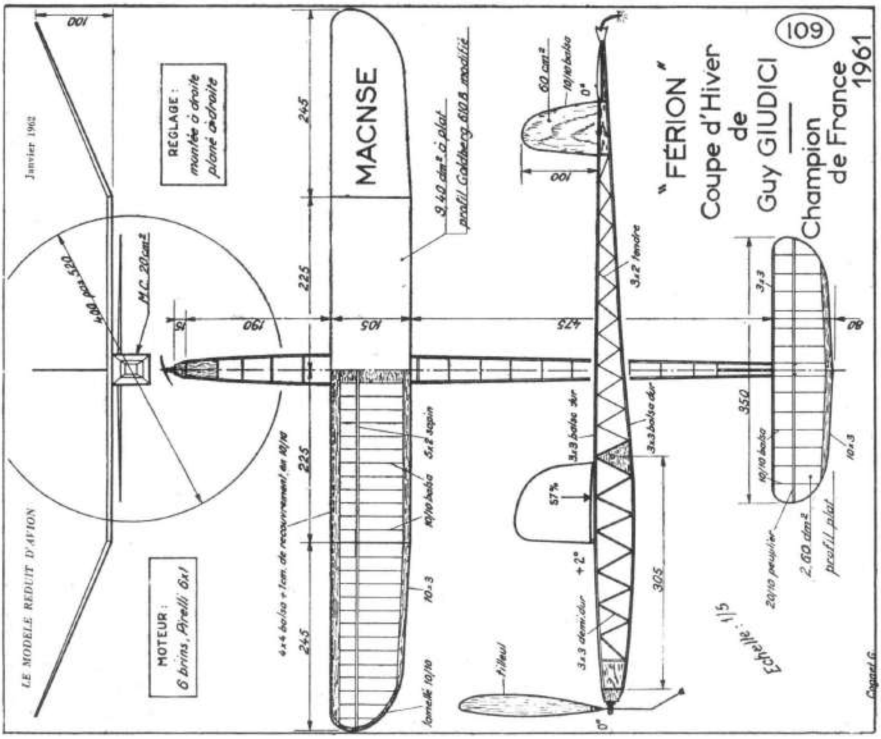

FALSE RIB
1/8" SQ. SPRUCE
RIBS 1/16" SHEET
1/32" SHEET GUSSET
FULL SIZE WING SECTION
3/16" SQ. LEADING EDGE
1/8" X 3/4" TRAILING EDGE
1/8" SQ. LEADING EDGE
TOP STAB RIBS SLICED FROM 1/16" SHEET
LOWER RIBS 1/16" SQ
1/16" X 1/8" SPAR
FULL SIZE STAB SECTION
1/8" X 1/2" TRAILING EDGE
1/32" PLYWOOD
1/16" DIA. WIRE SHAFT AND HUB
1/16" SHEET TOP
1/16" SQ. LONGERONS
BOTTOM- 1/16" SHEET
SECTION A-A
BIND WITH COPPER WIRE AND SOLDER
THRUST BEARING
HARD ALUMINUM HINGES
NOSE ASSEMBLY
1/32" DIA. WIRE SPRING
3/64" DIA. L.G. WIRE HINGE
TOP RIBS ARE SOLID LINES - BOTTOM RIBS ARE DASH LINES. 3/32" SH. SOLID RIBS AT CENTER AND TIPS.
FUSELAGE DETAILS
SIDES: 1/32" SH. WITH 1/32" SH. CROSSGRAIN FOR FIRST 13". TOP: 1/16" SH. FOR FIRST 14" BOTTOM: 1/16" SHEET FOR FIRST 11-3/4"
GLUE 1/16" SQ. LONGERONS TO TOP AND BOTTOM 1/16" SH. GLUE 1/32" SH. CROSSGRAIN, AND REAR 1/16" SQ. LONGERONS AND UPRIGHTS TO THE 1/32" SHEET SIDES BEFORE ASSEMBLY.
SCALE
0 2 4 6 8 10 12
INCHES
17"
3"
4-1/2"
5/8"
4"
3/8"
"B"
34"
LANDING GEAR STRUT
1-1/2" TYP.
4-1/2"
"A"
C.G.
11-1/2"
36" FLAT
1-1/4"
NOTE: LANDING GEAR STRUT IS 3/8" SQ. 8" LONG, WITH 1/32" x 1/2" x 8" GLUED TO SIDES.
PROPELLER LAYOUT
L.E.
T.E.
45° BLADE ANGLE
30° BLADE ANGLE
PROP BLADES 1/2 SCALE
PROP BLADES CUT FROM 1/2" SHEET BALSA
16" DIA.-20" PITCH
WEIGHTS
WING .66
STAB .19
FUSELAGE .81
FIN .06
PROP ASS'Y .60
WING MOUNT .12
L.G. STRUT .05
MOTOR .34
TOTAL 2.83
~~NOTE: ALL SECTIONS, TEMPLATES AND PATTERNS ARE FULL SIZE, UNLESS OTHERWISE SPECIFIED.~~
1/16" SQ. UPRIGHTS
1/16" SQ. LONGERONS
SECTION B-B
IMAC
DWARF DIP MK II
COUP d'HIVER RUBBER MODEL
DES. BY: CHARLES SOTICH
ILLINOIS MODEL AERO CLUB

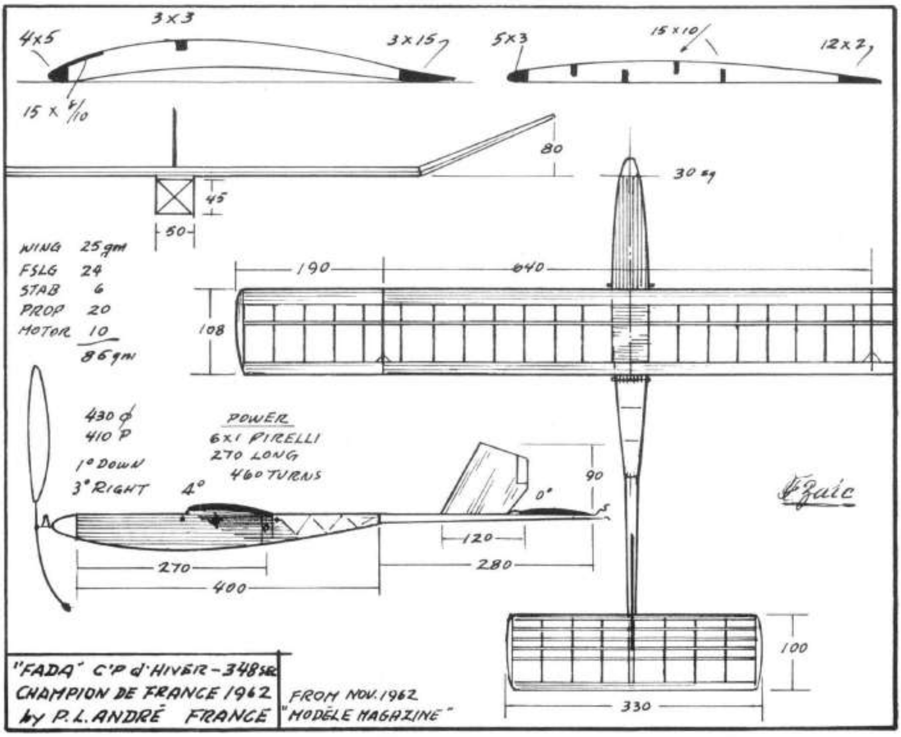


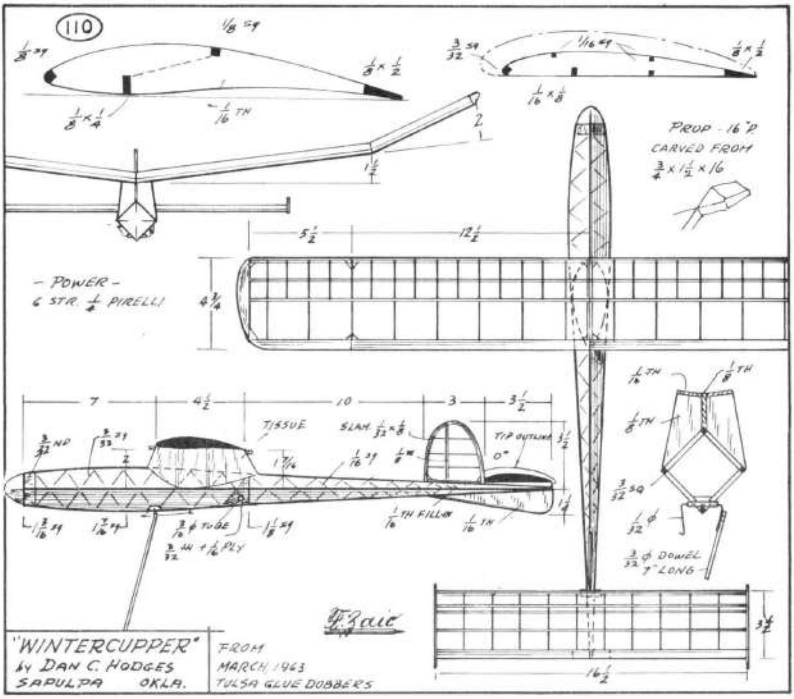


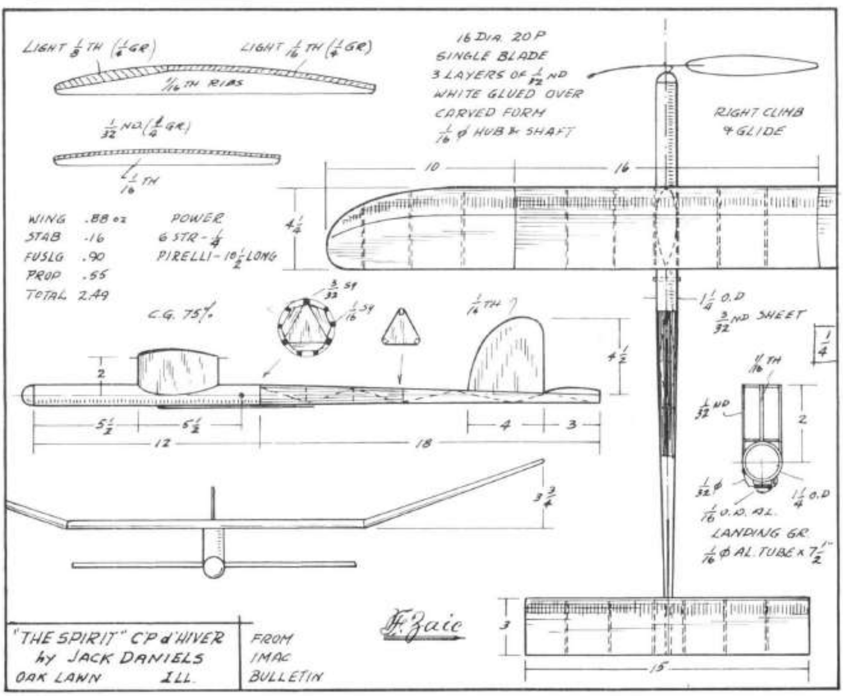
Individual results

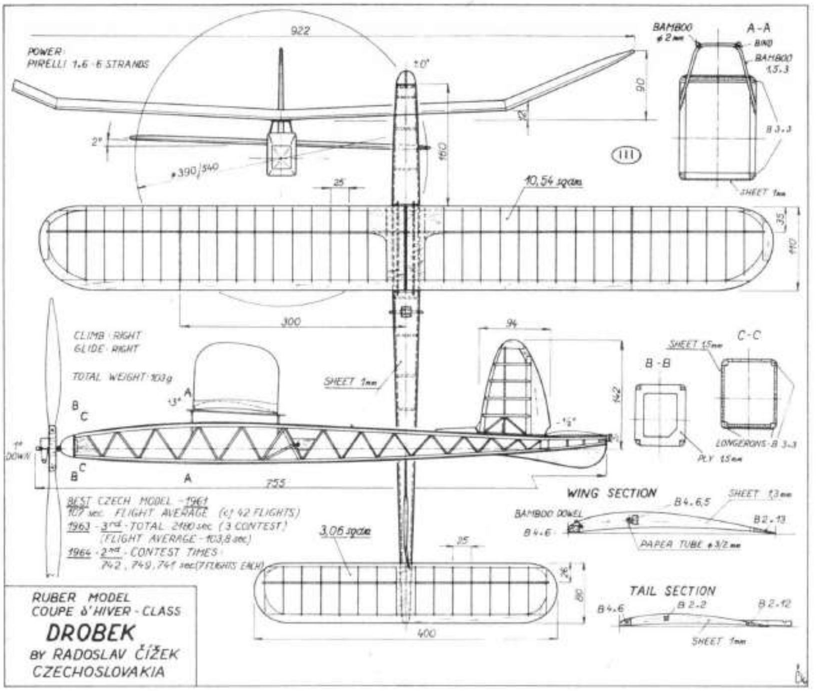
1	A. Landeau	47	120	119	**286**
2	B. Mardel	120	120	35	**275**
3	R. Poulain	79	68	120	**267**
4	B. Raulin	71	91	104	**266**
5	A. Meritte	120	62	76	**258**
6	P. Cameron	53	117	87	**257**
7	P. Maillert	99	89	59	**247**
8	J. O'Donnell	70	84	77	**231**
9	A. Bussiere	42	86	100	**228**
10	R. Quesnel	86	64	77	**227**
11	T. Faulkner	84	82	56	**222**
12	E. Gouverne	120	25	75	**220**


Janvier 1962
LE MODELE REDUIT D'AVION
"FÉRION"
Coupe d'Hiver
de
Guy GIUDICI
Champion
de France
1961
109
REGLAGE :
montée à droite
plané à droite
MOTEUR :
6 brins, Pirelli 6x1
MACNSE
M.C. 20 cm²
400 pas 520
9,40 dm² à plat
profil Goldberg 610 B modifié
60 cm²
10/10 balsa
100
3x2 tendre
3x3 balsa dur
57%
+2°
305
3x3 demi-dur
tilleul
Echelle : 1/5
2,60 dm²
profil plat
20/10 peuplier
10/10 balsa
10x3
350
80
3x3
245
225
105
190
15
425
5x2 sapin
10/10 balsa
10x3
lamelle 10/10

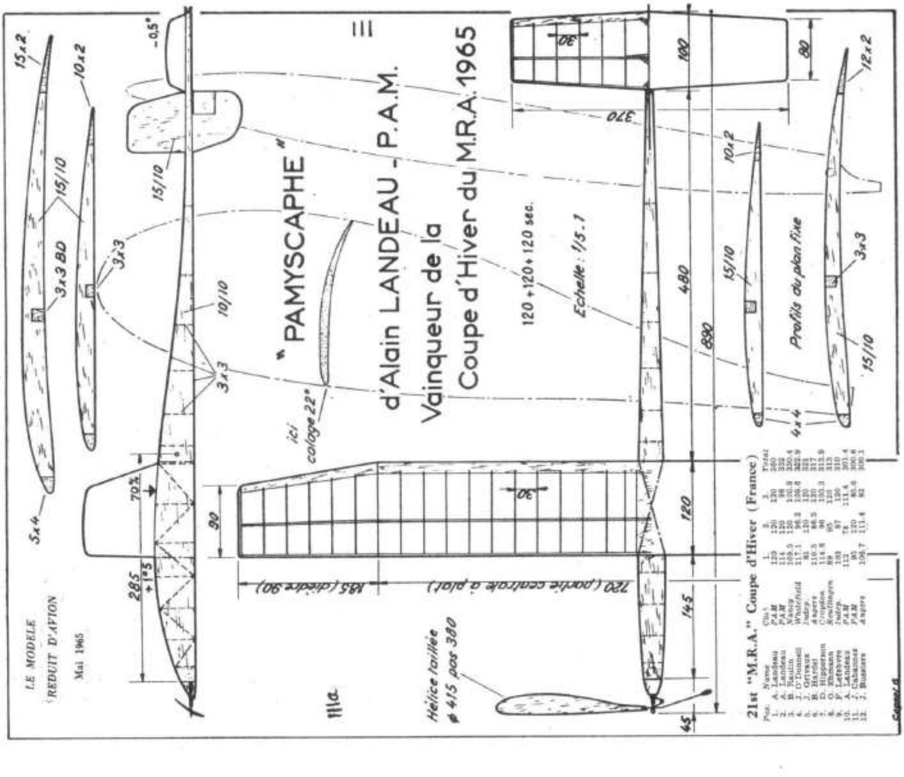

4x5
3x3
3x15
15 x 4/10
5x3
15x10
12x2
80
45
50
30 sq
WING 25 gm
FSLG 24
STAB 6
PROP 20
MOTOR 10
86 gm
190
640
108
430 ø
410 P
1° DOWN
3° RIGHT
4°
POWER
6x1 PIRELLI
270 LONG
460 TURNS
90
0°
120
270
280
400
100
330
"FADA" C'P d'HIVER - 348 sec
CHAMPION DE FRANCE 1962
by P.L. ANDRÉ FRANCE
FROM NOV. 1962
"MODÈLE MAGAZINE"
F Zaic


110
WINTERCUPPER
by DAN C. HODGES
SAPULPA OKLA.
FROM
MARCH, 1963
TULSA GLUE DOBBERS
PROP - 16" P
CARVED FROM
- POWER -
6 STR. 1/4 PIRELLI
TISSUE
TIP OUTLINE
F. Zaic

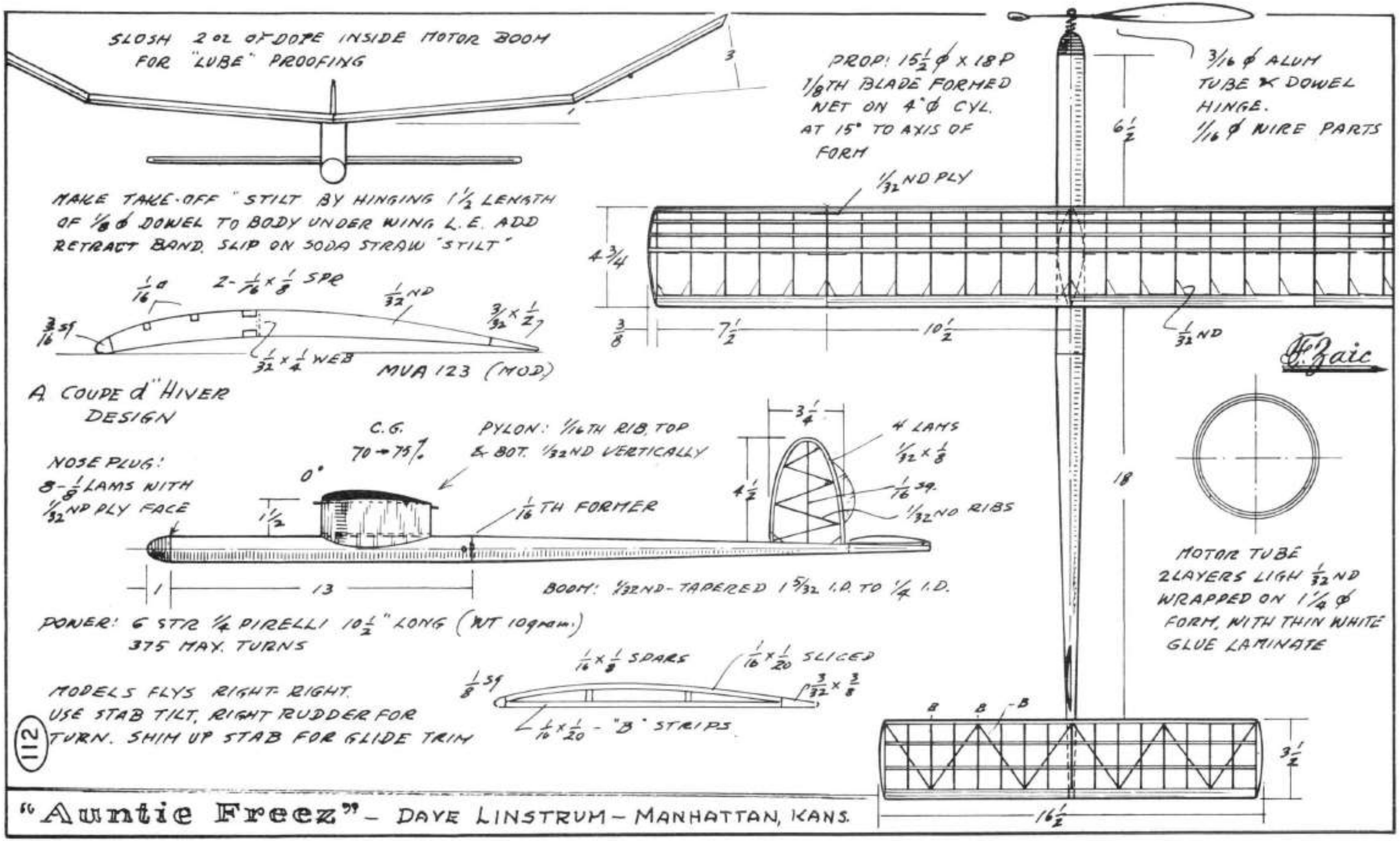

"THE SPIRIT" C.P d'HIVER
by JACK DANIELS
OAK LAWN ILL.
FROM
IMAC
BULLETIN
16 DIA. 20 P
SINGLE BLADE
WHITE GLUED OVER
CARVED FORM
RIGHT CLIMB
& GLIDE
WING .88 oz
STAB .16
FUSLG .90
PROP .55
TOTAL 2.49
POWER
C.G. 75%
LANDING GR.
F. Zaic



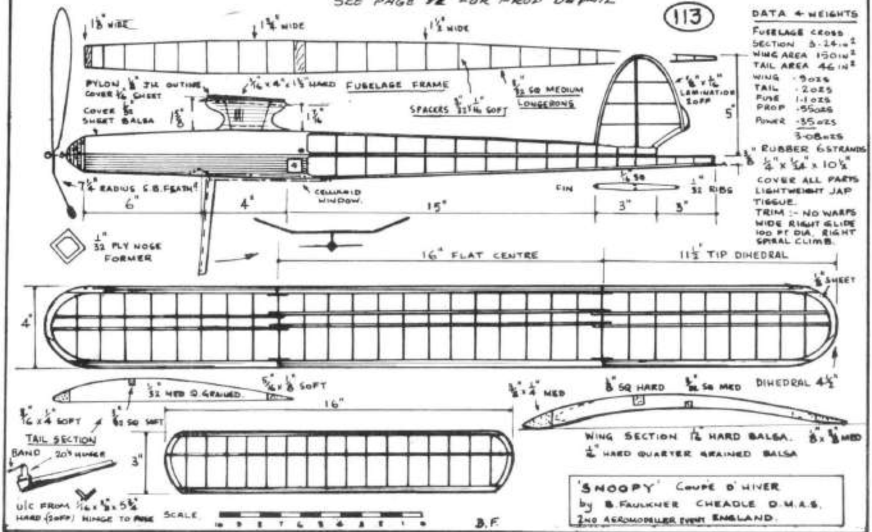
POWER: PIRELLI 1.6 · 6 STRANDS
922
CLIMB · RIGHT
GLIDE · RIGHT
TOTAL WEIGHT · 103g
10,54 sqdm
3,06 sqdm
SHEET 1mm
WING SECTION
TAIL SECTION
BAMBOO DOWEL
PAPER TUBE
LONGERONS · B 3.3
PLY 1.5mm
BEST CZECH MODEL - 1961
107 sec. FLIGHT AVERAGE (of 42 FLIGHTS)
1963 - 3rd - TOTAL 2480 sec. (3 CONTEST)
(FLIGHT AVERAGE - 103,8 sec)
1964 - 2nd - CONTEST TIMES:
742, 749, 741 sec (7 FLIGHTS EACH)
RUBER MODEL
COUPE D'HIVER - CLASS
DROBEK
BY RADOSLAV ČÍŽEK
CZECHOSLOVAKIA

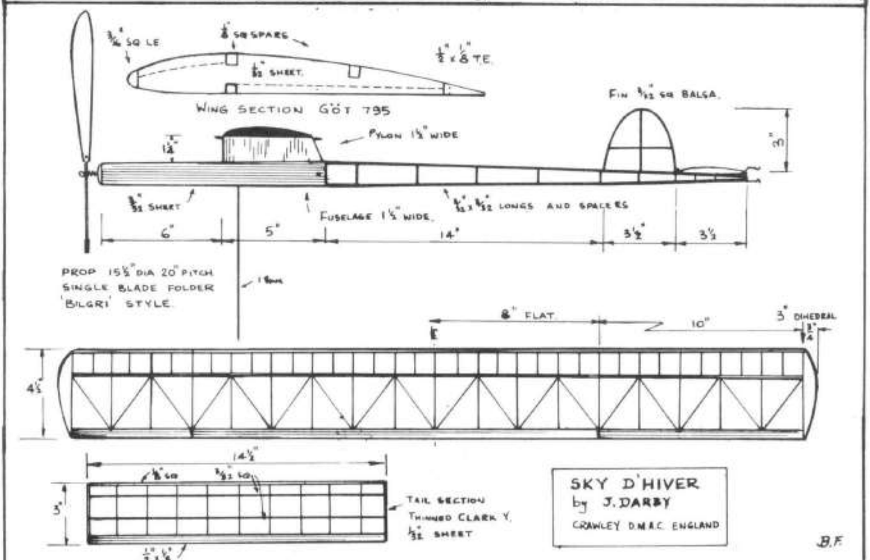


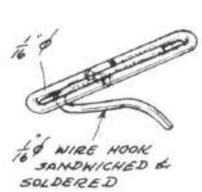
"PAMYSCAPHE"
d'Alain LANDEAU - P.A.M.
Vainqueur de la
Coupe d'Hiver du M.R.A. 1965
120 + 120 + 120 sec.
Echelle : 1/5.1
ici calage 22°
Profils du plan fixe
Hélice taillée ø 415 pas 380
LE MODELE REDUIT D'AVION
Mai 1965
21st "M.R.A." Coupe d'Hiver (France)

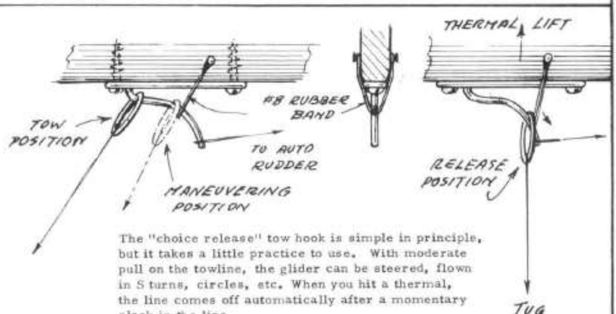

SLOSH 2 oz OF DOPE INSIDE MOTOR BOOM
FOR "LUBE" PROOFING
3
1
MAKE TAKE-OFF "STILT" BY HINGING 1 1/2 LENGTH
OF 1/8 ϕ DOWEL TO BODY UNDER WING L.E. ADD
RETRACT BAND. SLIP ON SODA STRAW "STILT"
1/16 a
2 - 1/16 x 1/8 SPR
1/32 ND
3/16 sq
3/32 x 1/2
1/32 x 1/4 WEB
MVA 123 (MOD)
A COUPE d' HIVER
DESIGN
PROP: 15 1/2 ϕ x 18 P
1/8 TH BLADE FORMED
WET ON 4" ϕ CYL.
AT 15° TO AXIS OF
FORM
1/32 ND PLY
3/16 ϕ ALUM
TUBE & DOWEL
HINGE.
1/16 ϕ WIRE PARTS
6 1/2
4 3/4
3/8
7 1/2
10 1/2
1/32 ND
F. Zaic
C.G.
70 → 75%
PYLON: 1/16 TH RIB, TOP
& BOT. 1/32 ND VERTICALLY
NOSE PLUG:
8 - 1/8 LAMS WITH
1/32 ND PLY FACE
0°
1 1/2
1/16 TH FORMER
3 1/4
4 LAMS
1/32 x 1/8
4 1/2
1/16 sq.
1/32 ND RIBS
18
1
13
BOOM: 1/32 ND - TAPERED 1 5/32 I.D. TO 1/4 I.D.
MOTOR TUBE
2 LAYERS LIGH 1/32 ND
WRAPPED ON 1 1/4 ϕ
FORM, WITH THIN WHITE
GLUE LAMINATE
POWER: 6 STR 1/4 PIRELLI 10 1/2" LONG (WT 10 gram.)
375 MAX. TURNS
1/16 x 1/8 SPARS
1/16 x 1/20 SLICED
1/8 sq
3/32 x 3/8
1/16 x 1/20 - "B" STRIPS
B
B
B
3 1/2
16 1/2
MODELS FLYS RIGHT-RIGHT.
USE STAB TILT, RIGHT RUDDER FOR
TURN. SHIM UP STAB FOR GLIDE TRIM
112
"Auntie Freez" - DAVE LINSTRUM - MANHATTAN, KANS.

SEE PAGE 92 FOR PROP DETAIL









The "choice release" tow hook is simple in principle, but it takes a little practice to use. With moderate pull on the towline, the glider can be steered, flown in S turns, circles, etc. When you hit a thermal, the line comes off automatically after a momentary slack in the line.

OMNI-DIRECTION TOW HOOK

HANK COLE — LOS ALTOS, CALIF.

A-2 DEVELOPMENT

Jim Baguley England

The A-2 developed in 1962 to 1964 was intended to be one of reasonable performance which would never change trim. The first one built was the best, chalking up an excellent contest record in 1963. Even though becoming battered by the 1963 Championships, I think I would have fared better had I not lost it before. It had that certain something which none I have built of this series have had since. However, other people have built the final version or similar designs and have had a fair amount of success. The main fault I had in the 1964 season with this design was a tendency to sideslip out of lift if the turn was taken a little too tight and this accounted for several poor contest results.

Then, I decided that the time had come to continue experiment and that I did not have the last answer in a general purpose A-2. The first experiment was based on an A-2 similar to the "final" version but with higher Aspect Ratio, polydihedral, one inch rib spacing with no spars touching the surface and lots of complicated internal bracing. It had never flown very well. The main reason for this was decided to be uneven wood selection in the wings, so they were balanced and to get a straight tow because they flexed unevenly were trimmed to straight Vee dihedral of massive proportions. It was then natural that Vee tail and underfin should follow to prevent the tailplane being frequently damaged that a long pod nose should make it to balance at the correct C.G. position and that the lower side area should balance the large dihedral. It proved to be lift prone and could circle very tightly with no sign of sideslipping. It was used in the Trials and a hopeless mess resulted. Only afterwards did I discover that the towhook was much too far back, causing peeling off when looking for vital lift. When this had been rectified, it was used in the SMAE Comp at the end of 1964 and had 5 maxes with ease to win despite a poor fly-off time caused by a poor glide.

Taking stock of the situation, I decided that this model which had been a joke had something despite its still air time of little over 2 minutes. The first thing to do was to build a couple of other peoples designs to learn something, then to incorporate if possible ideas (particularly in construction) which I had had for a long time. These items related particularly to the B 6456 f airfoil which had been used by fellow club member Robin Sleigh and which I knew was capable of fantastic glide.

The first model built, however, was the Lindner "Kria" (1955/56 Y.B.) because the Germans have often done well in rough weather and also 3:20 was claimed for it in still air. Even though mine is well made, trimmed to a good glide and with not too small a circle diameter I am sure that it is not good for more than 2:40 with everything just right. This ties up with my impression when early morning flying in Austria in 1963. The best of our British A-2s were doing around 2:25 while the best of other A-2s seemed to be doing around 2:30 to 2:40, not the 3:00 often claimed. The "Kria" also seemed fairly happy in rough weather and holds lift fairly well. A particularly pleasing characteristic was a "following" in tow; even cross wind for a while.

The next was an H.k.43 (which is again German) because it had an impressive contest record and is so ugly I couldn't resist it! It has a massive pod nose, sharply upswept tapered tips at the end of long center sections, underfin, small dihedralled tail on short moment arm, etc. It uses an Isacsen type section of the type which went out years ago and the typical drooped German tail section. It proved easy to trim and very stable. The tow is straight and arrow like once established. Until trimmed for tight turn its stall recovery was not brilliant but the long nose and consequent large inertia is suspect here. In "still" air it is a dead loss; I would rate it at 2:10 or thereabouts. However, I think it will be just the job for gusty, clear summer days.

Neither of these models had the fault of my own design so the first of a new series was dreamed up from lessons learned. B 7357 d/2 was selected as alleged to have a good glide. The idea of smooth undersurface (sheeted) and turbulated spar interrupted upper surface was tried, similar to an arrangement Tony Young is using. Polydihedral was thought to be best to achieve the flat turn desired and high Aspect Ratio used as on the "Kria" (also coinciding with my present ideas on the best Aspect Ratio for the current state of the wing section and construction art). The typical Lindner tail section was used to give a stable controlled glide. Moment arm and tail area combination was less powerful than I normally use since I think I have been over-controlling. The nose was long for balance of a strong fuselage as wings are also fairly heavy (7 oz.) and drooped to keep the C.G. as low as reasonably possible.

I have not flown it much but used it for 3 flights and the "Kria" for 2 in our K.M.A.A. Cup to achieve 5 maxs again! It seems to have something, again exhibiting no sideslipping tendencies even with tight turn (which I am beginning to think is an essential); also seems to have a decided afinity for lift. Inertias are not low so stalled recovery is not quick but I feel this may help prevent gust disturbances as when settled nothing seems to upset it. I feel that the tail & fuselage are, however, a little too heavy. In still air, I believe it to be capable of 2:25 which is reasonable and the fly-off time in rain (after a false start which did around 3:00) was 2:18. To summarize, I have gone away from the tight bounce, stall and turn approach to the smooth but tight trim, and I think this new series worth development. First things to do are to get to B 6456 f and lighten the fuselage. Heavy wings, I am convinced do not matter. Of course, the flier still matters most and here again patience in waiting for lift is the key. There has, however, been plenty written on this which is better than I can contribute at this stage.

CONSTRUCTION OF DRIFT AND CIRCLING PATH

F. Ludwig Germany

I read your 1959-61 Year Book with great pleasure. I noticed on Page 151 that there is a question regarding the size and shape of flight figures of a model at various velocities. I am enclosing calculations and corresponding curves representing the flight path of a model relative to the ground, at various wind velocities. I hope they will provide the right answer to the question.

The flight path of a model relative to ground consists of two components, rotation and movement with wind.
Coordinates for rotation are found by:

$$\sin \omega t = \frac{-X_1}{r} \; ; \qquad X_1 = -r \sin \omega t \qquad (1)$$

$$\cos \omega t = \frac{r - y_1}{R} \; ; \qquad y_1 = r(1 - \cos \omega t) \qquad (2)$$

Movement (flight) in "X" or wind direction.
In the time "t" the center of the circle "M" (Fig. 1) has traveled the distance $V_x t = p \omega t$

Coordinate of flight alone:

$$X = p\omega t + X_1 \qquad (3) \qquad\qquad y = y_1 \qquad (4)$$

(3) and (4) inserted in (1) and (2) give the combined movement:

$$\boxed{\begin{aligned} x &= p\omega t - r \sin \omega t \\ y &= r(1 - \cos \omega t) \end{aligned}}$$

EX: Vw = 2 Vm p = 2 r $\omega t = \pi/4$ r = 1Unit

$$x = 2\ \pi/4 - 1 \sin \omega t \qquad y = 1(1 - 0.71)$$

$$x = 2 \cdot 0.785 - 1 \cdot 0.71 \qquad y = 0.25 \text{ UNIT}$$

$$X = 1.58 - 0.71$$

SEE POSITION "EX" ON CHART

$X \doteq 0.87$ OF A UNIT

$\omega = \frac{2\pi}{t}$ (sec^{-1}) ω = Angular velocity p = distance (m)

t = time of cycle (sec.) r = radius of flight (m)

Vx = p ω (ms^{-1}) Vel. in X direction (Corres. with wind)

Vu = r ω Corresponds to model velocity

Translated by Carmen

Ref: K. Strubecker, Intro. to Higher Math., Oldenburg,

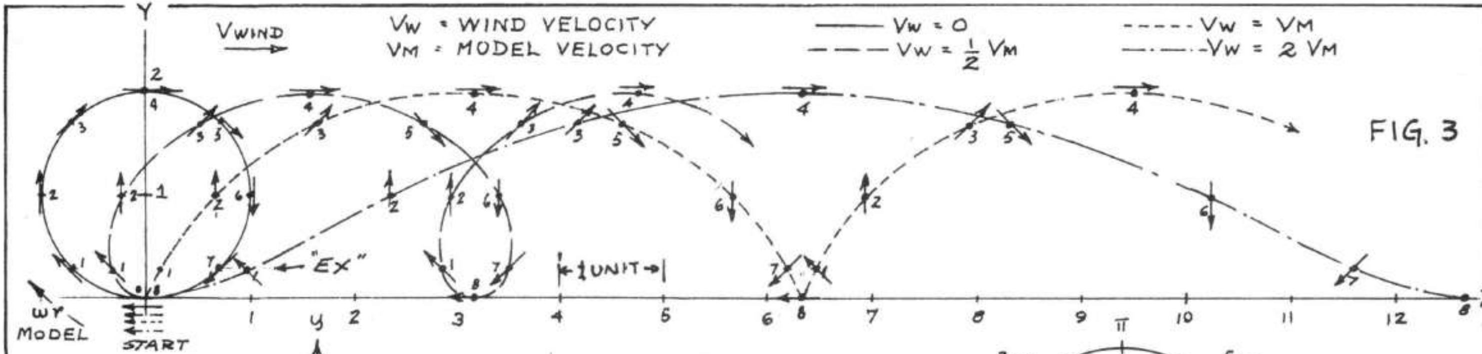


FIG. 3

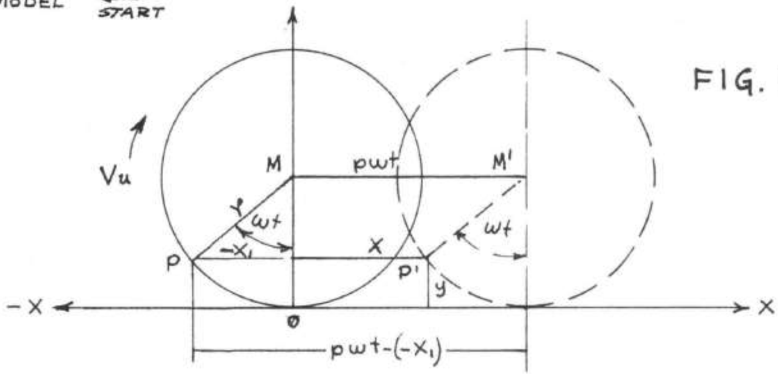


FIG. 1

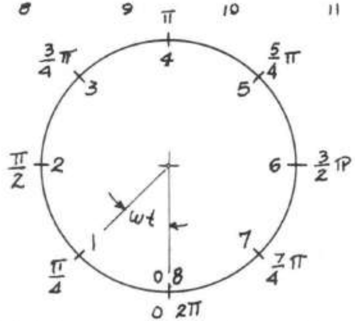
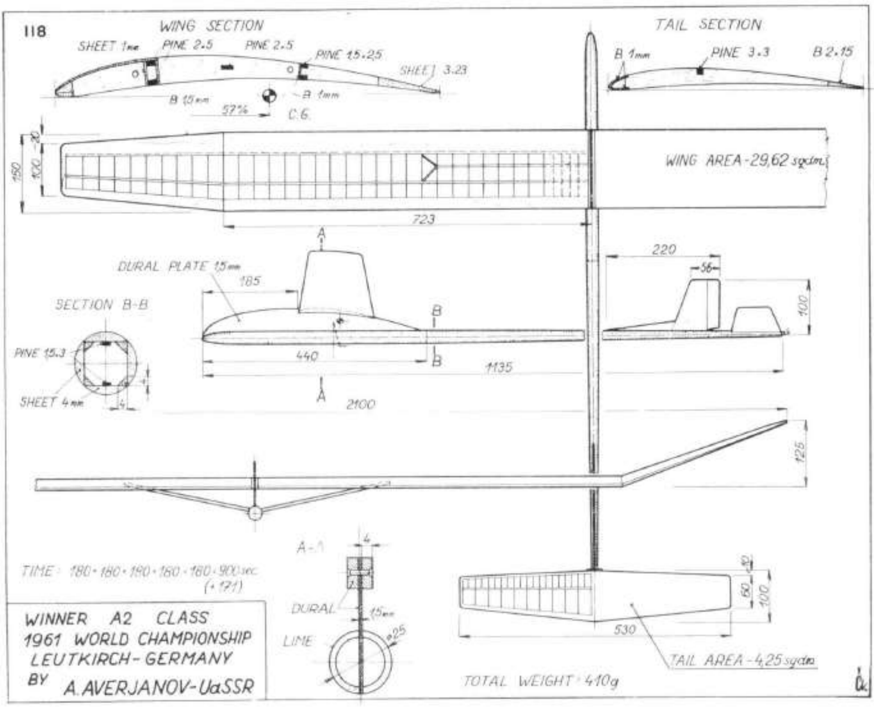


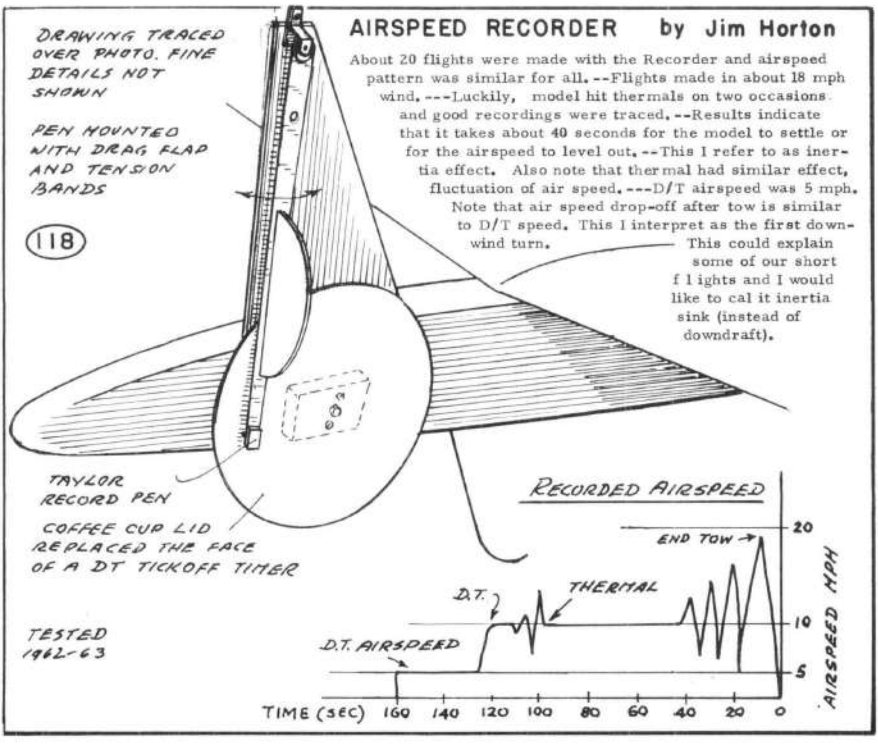
FIG. 2

FOUR EXAMPLES ARE CONSIDERED

1.	$V_W = 0$	$p\omega = 0\omega r$	$p = 0r$
2.	$V_W = \frac{1}{2} V_M$	$p\omega = \frac{1}{2}\omega r$	$p = \frac{1}{2} r$
3.	$V_W = V_M$	$p\omega = \omega r$	$p = 1r$
4.	$V_W = 2 V_M$	$p\omega = 2\omega r$	$p = 2r$

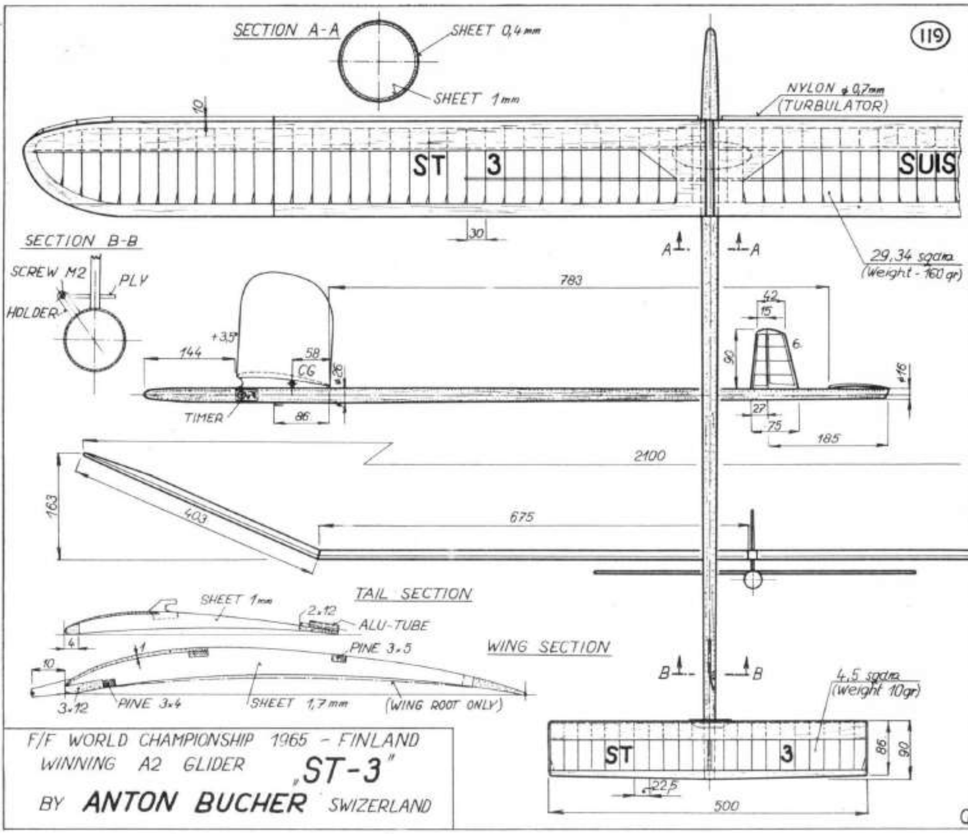
We are told that once a model becomes airborne, it becomes a part of the air mass, and it is moved along like a fish in a bowl. Some of us seem to doubt this presentation and feel there is more to it. At the moment we have no counter reply, but it seems that some sort of an experiment should be devised to answer the question and eliminate doubts. — In the meantime, if a model becomes a part of the air mass when it is released and the relative ground speed has no influence, how can we account for a model that will circle in calm but will tend to weather-cock in wind? We know that it has too much fin or vertical area behind the C.G., but why should this extra area become dominant in wind? F.Z.

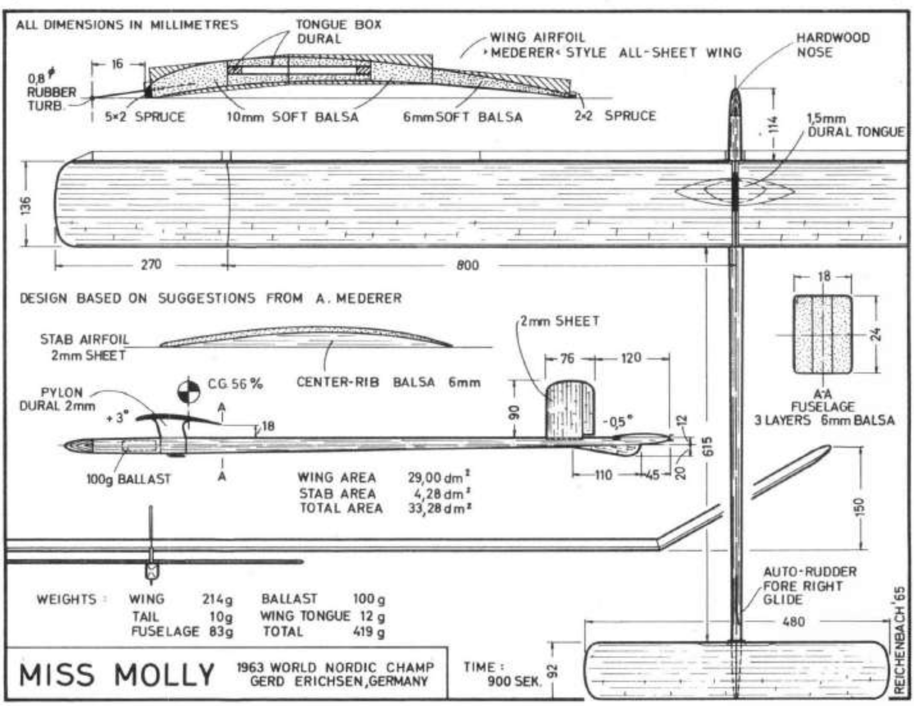


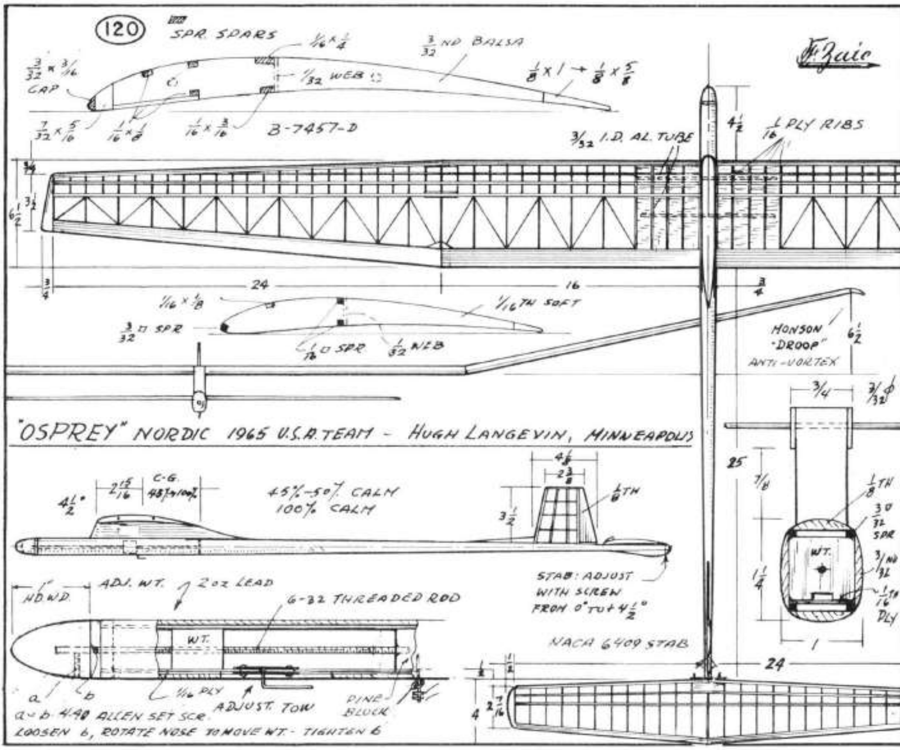


AIRSPEED RECORDER by Jim Horton

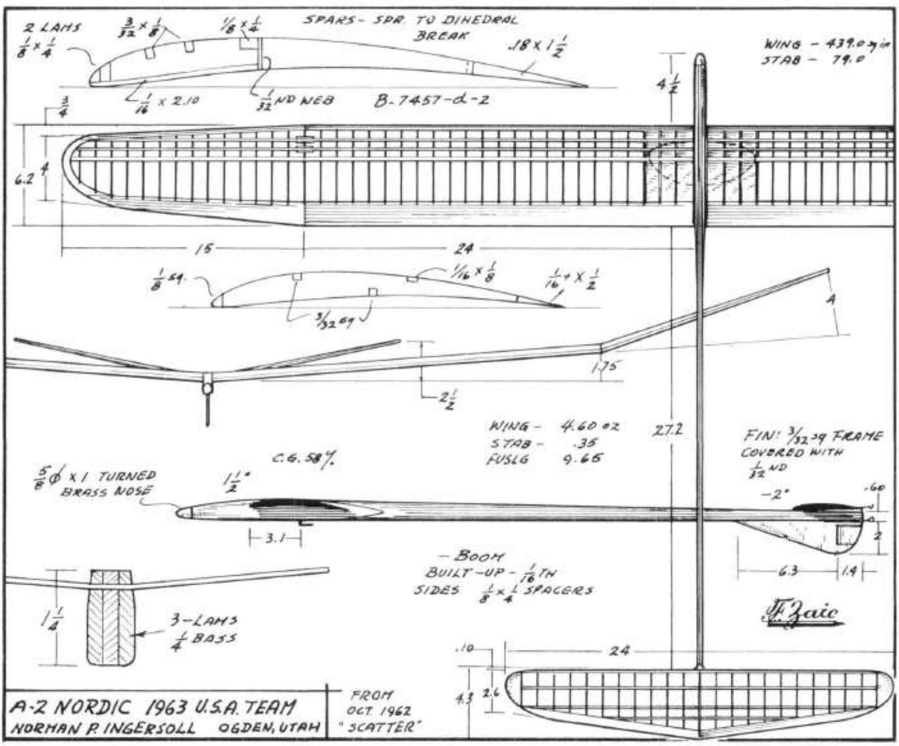
About 20 flights were made with the Recorder and airspeed pattern was similar for all. --Flights made in about 18 mph wind. ---Luckily, model hit thermals on two occasions and good recordings were traced. --Results indicate that it takes about 40 seconds for the model to settle or for the airspeed to level out. --This I refer to as inertia effect. Also note that thermal had similar effect, fluctuation of air speed. ---D/T airspeed was 5 mph. Note that air speed drop-off after tow is similar to D/T speed. This I interpret as the first downwind turn. This could explain some of our short f lights and I would like to cal it inertia sink (instead of downdraft).


119
SECTION A-A
SHEET 0,4 mm
SHEET 1 mm
NYLON ϕ 0,7 mm
(TURBULATOR)
10
ST 3
SUIS
30
A A
29,34 sqdm
(Weight - 160 gr)
SECTION B-B
SCREW M2
PLY
HOLDER
783
42
15
+3,5°
144
58
CG
ϕ28
90
6
ϕ16
TIMER
86
27
75
185
2100
163
403
675
TAIL SECTION
SHEET 1 mm
2x12
ALU-TUBE
4
PINE 3x5
WING SECTION
10
3x12
PINE 3x4
SHEET 1,7 mm
(WING ROOT ONLY)
B B
4,5 sqdm
(weight 10gr)
F/F WORLD CHAMPIONSHIP 1965 - FINLAND
WINNING A2 GLIDER „ST-3"
BY ANTON BUCHER SWIZERLAND
ST 3
22,5
86
90
500

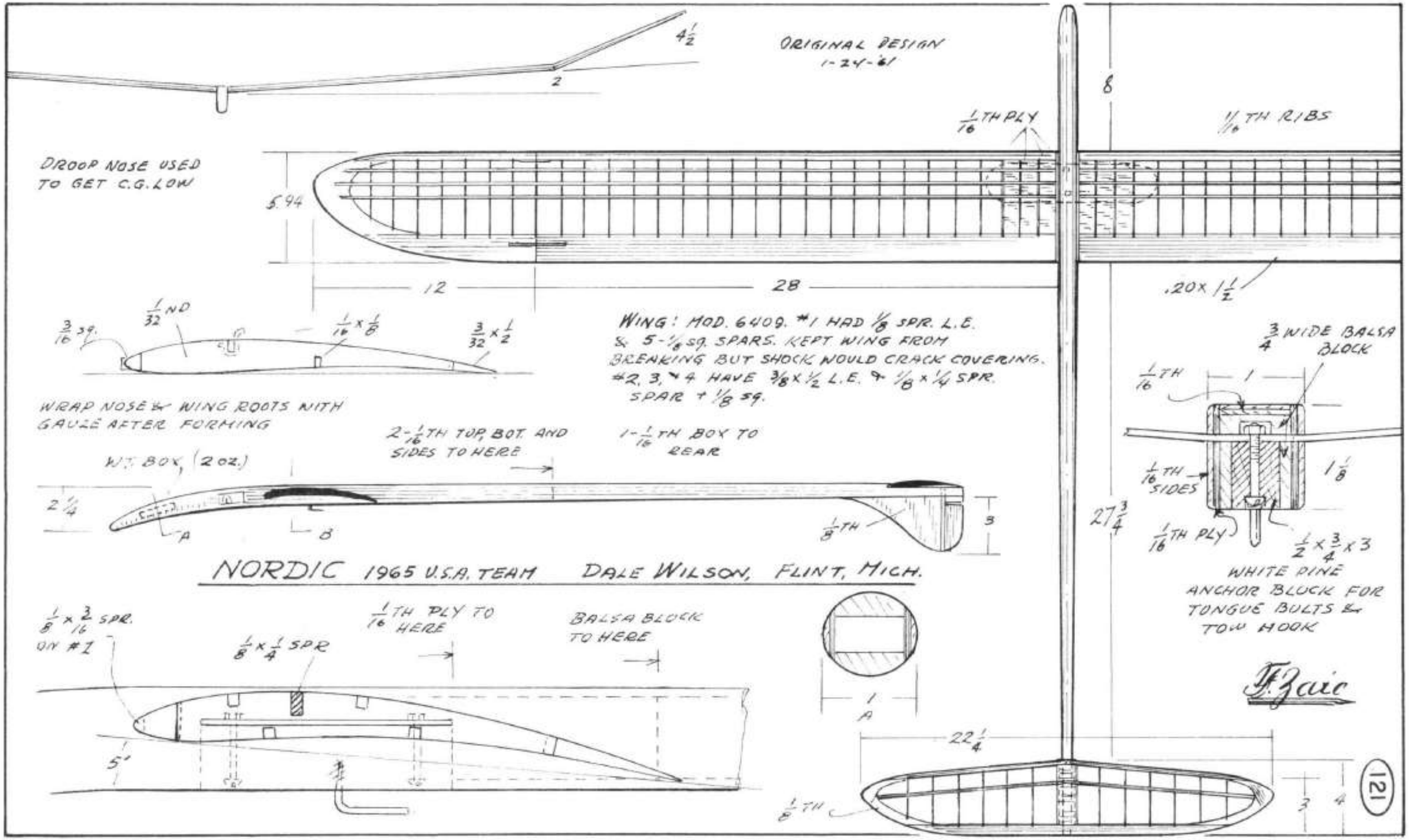

ALL DIMENSIONS IN MILLIMETRES
TONGUE BOX
DURAL
WING AIRFOIL
›MEDERER‹ STYLE ALL-SHEET WING
HARDWOOD
NOSE
16
0,8ϕ
RUBBER
TURB.
5x2 SPRUCE
10mm SOFT BALSA
6mm SOFT BALSA
2x2 SPRUCE
114
1,5mm
DURAL TONGUE
136
270
800
DESIGN BASED ON SUGGESTIONS FROM A. MEDERER
2mm SHEET
18
STAB AIRFOIL
2mm SHEET
CENTER-RIB BALSA 6mm
76
120
24
C.G. 56 %
PYLON
DURAL 2mm
+3°
A
18
90
-0,5°
12
A-A
FUSELAGE
3 LAYERS 6mm BALSA
100g BALLAST
A
WING AREA 29,00 dm²
STAB AREA 4,28 dm²
TOTAL AREA 33,28 dm²
110
45
20
615
150
AUTO-RUDDER
FORE RIGHT
GLIDE
WEIGHTS : WING 214g BALLAST 100 g
TAIL 10g WING TONGUE 12 g
FUSELAGE 83g TOTAL 419 g
480
REICHENBACH '65
MISS MOLLY
1963 WORLD NORDIC CHAMP
GERD ERICHSEN, GERMANY
TIME :
900 SEK.
92

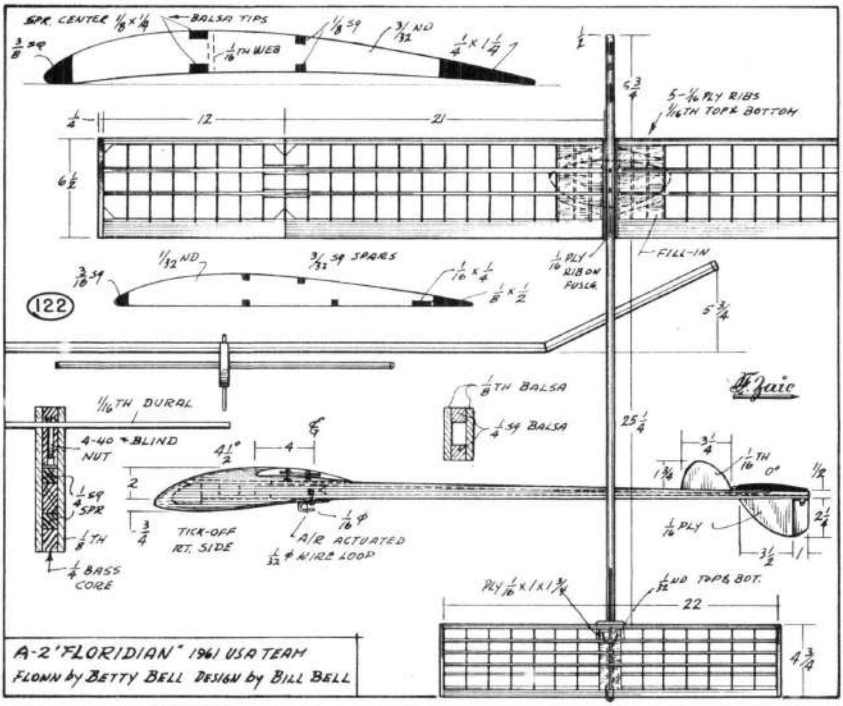


120
SPR. SPARS
1/16 x 1/4
3/32 ND BALSA
3/32 x 3/16 CAP
1/32 WEB
1/8 x 1 → 1/8 x 5/8
7/32 x 5/16
1/16 x 1/8
1/16 x 3/16
B-7457-D
3/32 I.D. AL. TUBE
1/16 PLY RIBS
24
16
1/16 x 1/8
1/16 TH SOFT
3/32 □ SPR
1/16 □ SPR
1/32 WEB
MONSON "DROOP" ANTI-VORTEX
"OSPREY" NORDIC 1965 U.S.A. TEAM - HUGH LANGEVIN, MINNEAPOLIS
C.G. 48% → 100%
45%-50% CALM
100% CALM
1/8 TH
STAB: ADJUST WITH SCREW FROM 0° TO + 4 1/2°
NACA 6409 STAB
ADJ. WT.
2 oz LEAD
6-32 THREADED ROD
WT.
1/16 PLY
ADJUST. TOW
PINE BLOCK
a = b 4-40 ALLEN SET SCR.
LOOSEN b, ROTATE NOSE TO MOVE WT. - TIGHTEN b
1/8 TH
3/32 □ SPR
3/32 ND
1/16 TH PLY

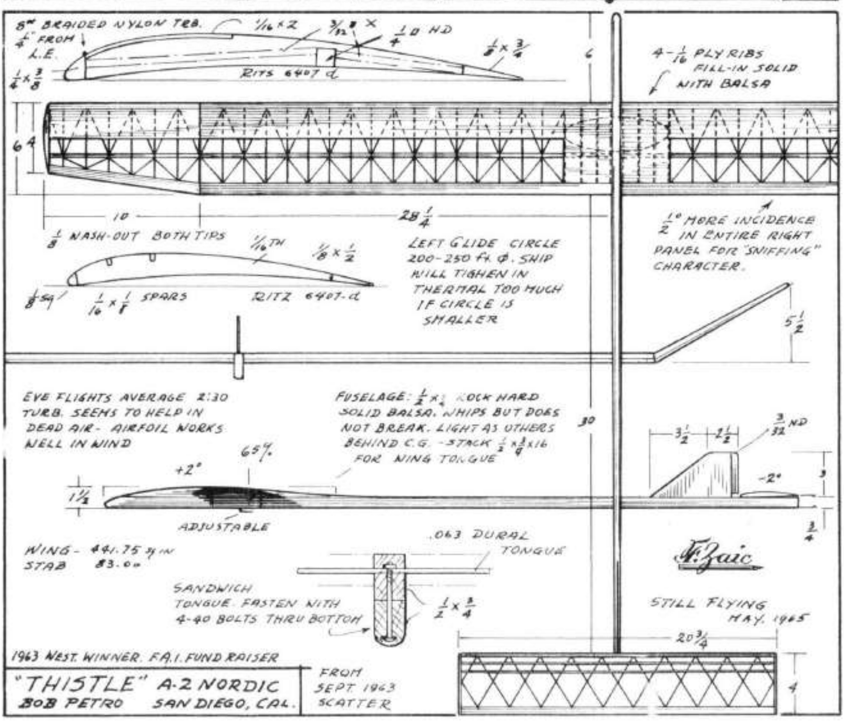


2 LAMS 1/8 x 1/4
3/32 x 1/8
1/8 x 1/4
SPARS - SPR. TO DIHEDRAL BREAK
.18 x 1 1/2
WING - 439.0 sq in
STAB - 79.0
1/16 x 2.10
1/32 ND WEB
B-7457-d-2
16
24
1/8 sq.
1/16 x 1/8
1/16 x 1/2
3/32 sq
1.75
WING - 4.60 oz
STAB - .35
FUSLG 9.65
27.2
FIN: 3/32 sq FRAME COVERED WITH 1/32 ND
C.G. 58%
5/8 ⌀ x 1 TURNED BRASS NOSE
-BOOM BUILT-UP - 1/16 TH SIDES 1/8 x 1/4 SPACERS
3-LAMS 1/4 BASS
A-2 NORDIC 1963 U.S.A. TEAM
NORMAN P. INGERSOLL OGDEN, UTAH
FROM OCT. 1962 "SCATTER"

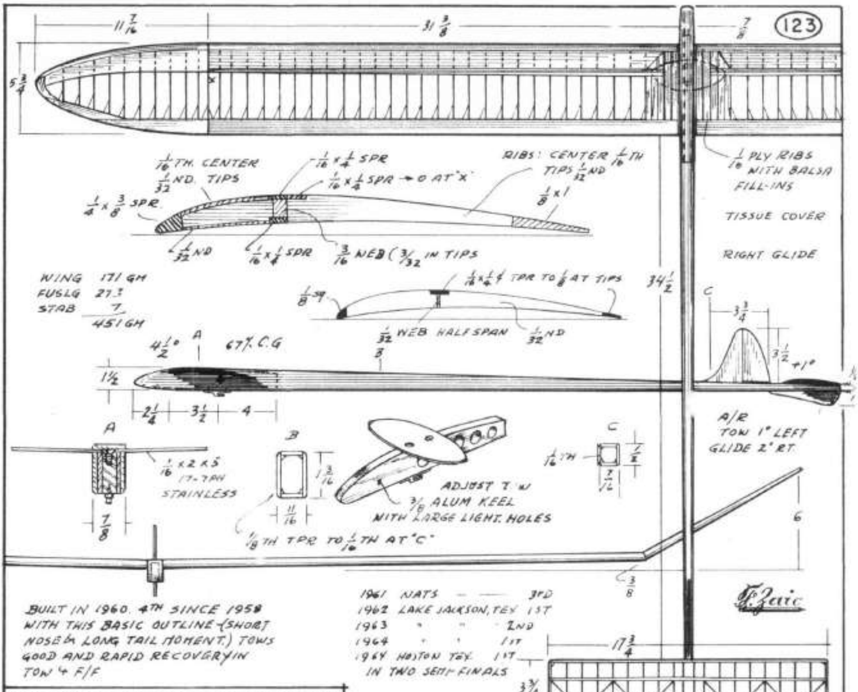

ORIGINAL DESIGN
1-24-61
4 1/2
2
8
1/16 TH PLY
1/16 TH RIBS
DROOP NOSE USED
TO GET C.G. LOW
5.94
12
28
.20 X 1 1/2
3/16 SQ.
1/32 ND
1/16 X 1/8
3/32 X 1/2
WING: MOD. 6409. #1 HAD 1/8 SPR. L.E.
& 5-1/8 SQ. SPARS. KEPT WING FROM
BREAKING BUT SHOCK WOULD CRACK COVERING.
#2, 3, & 4 HAVE 3/8 X 1/2 L.E. & 1/8 X 1/4 SPR.
SPAR + 1/8 SQ.
3/4 WIDE BALSA
BLOCK
1/16 TH
1
WRAP NOSE & WING ROOTS WITH
GAUZE AFTER FORMING
2-1/16 TH TOP, BOT. AND
SIDES TO HERE
1-1/16 TH BOX TO
REAR
WT. BOX, (2 OZ.)
2 1/4
A
B
1/8 TH
3
1/16 TH
SIDES
1 1/8
27 3/4
1/16 TH PLY
1/2 X 3/4 X 3
NORDIC 1965 U.S.A. TEAM DALE WILSON, FLINT, MICH.
WHITE PINE
ANCHOR BLOCK FOR
TONGUE BOLTS &
TOW HOOK
1/8 X 3/16 SPR.
ON #1
1/16 TH PLY TO
HERE
BALSA BLOCK
TO HERE
1/8 X 1/4 SPR
1
A
F. Zaic
22 1/4
5°
1/8 TH
3
4
121



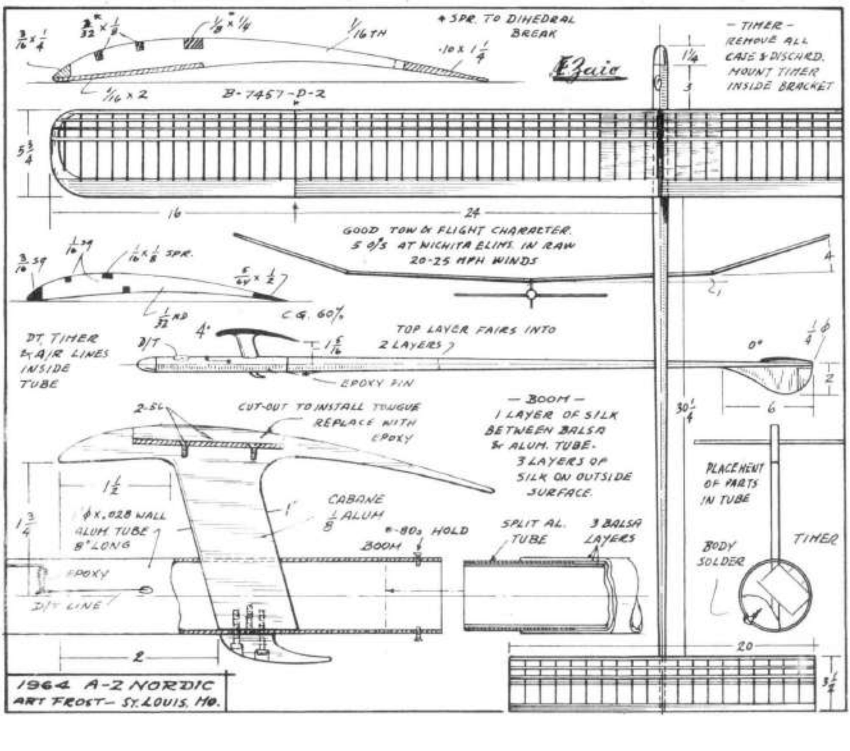
SPR. CENTER 1/8 x 1/4
BALSA TIPS
3/8 SQ
1/16 TH WEB
1/8 SQ
3/32 ND
1/4 x 1 1/4
1/2
5 3/4
5-1/16 PLY RIBS
1/16 TH TOP & BOTTOM
1/4
12
21
6 1/2
FILL-IN
1/32 ND
3/32 SQ SPARS
3/16 SQ
1/16 x 1/4
1/8 x 1/2
1/16 PLY RIB ON FUSLG.
122
5 3/4
F. Zaic
1/16 TH DURAL
4-40 BLIND NUT
1/4 SQ SPR
1/8 TH
1/4 BASS CORE
1/8 TH BALSA
1/4 SQ BALSA
25 1/4
4 1/2°
4
2
3/4
TICK-OFF RT. SIDE
1/16 φ
A/R ACTUATED
1/32 φ WIRE LOOP
3 1/4
1/16 TH
0°
1 3/4
1/2
2 1/4
1/16 PLY
3 1/2
1
PLY 1/16 x 1 x 1 3/4
1/32 ND TOP & BOT.
22
4 3/4
A-2 "FLORIDIAN" 1961 USA TEAM
FLOWN by BETTY BELL DESIGN by BILL BELL



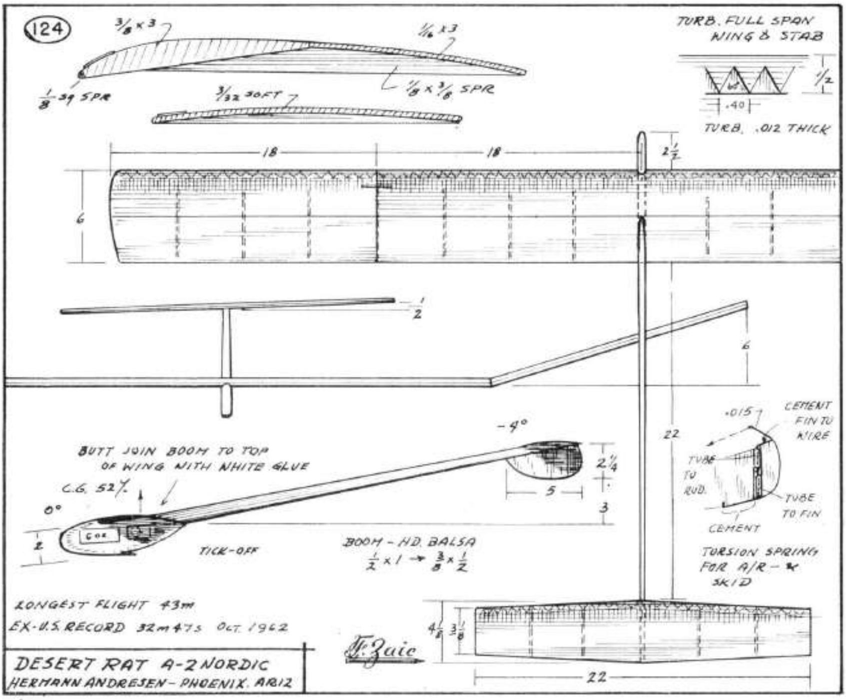
8" BRAIDED NYLON TRB.
1/4" FROM L.E.
1/16 x 2
3/32 SQ x
1/4 D HD
1/8 x 3/4
1/4 x 3/8
RITS 6407 d
6
4-1/16 PLY RIBS
FILL-IN SOLID WITH BALSA
6 4
10
28 1/4
1/8 WASH-OUT BOTH TIPS
1/16 TH
1/8 x 1/2
1/8 SQ
1/16 x 1/8 SPARS
RITZ 6407-d
LEFT GLIDE CIRCLE 200-250 ft. φ. SHIP WILL TIGHEN IN THERMAL TOO MUCH IF CIRCLE IS SMALLER
1/2° MORE INCIDENCE IN ENTIRE RIGHT PANEL FOR "SNIFFING" CHARACTER.
5 1/2
EVE FLIGHTS AVERAGE 2:30
TURB. SEEMS TO HELP IN DEAD AIR - AIRFOIL WORKS WELL IN WIND
FUSELAGE: 1/2 x 1/2 ROCK HARD SOLID BALSA. WHIPS BUT DOES NOT BREAK. LIGHT AS OTHERS BEHIND C.G. - STACK 1/2 x 3/8 x 16 FOR WING TONGUE
30
3 1/2
2 1/2
3/32 ND
3
-2°
65%
+2°
1 1/2
ADJUSTABLE
3/4
WING - 441.75 sq in
STAB 83.0 "
.063 DURAL TONGUE
F. Zaic
SANDWICH TONGUE. FASTEN WITH 4-40 BOLTS THRU BOTTOM
1/2 x 3/4
STILL FLYING MAY, 1965
20 3/4
4
1963 WEST. WINNER. F.A.I. FUND RAISER
"THISTLE" A-2 NORDIC
BOB PETRO SAN DIEGO, CAL.
FROM SEPT. 1963 SCATTER



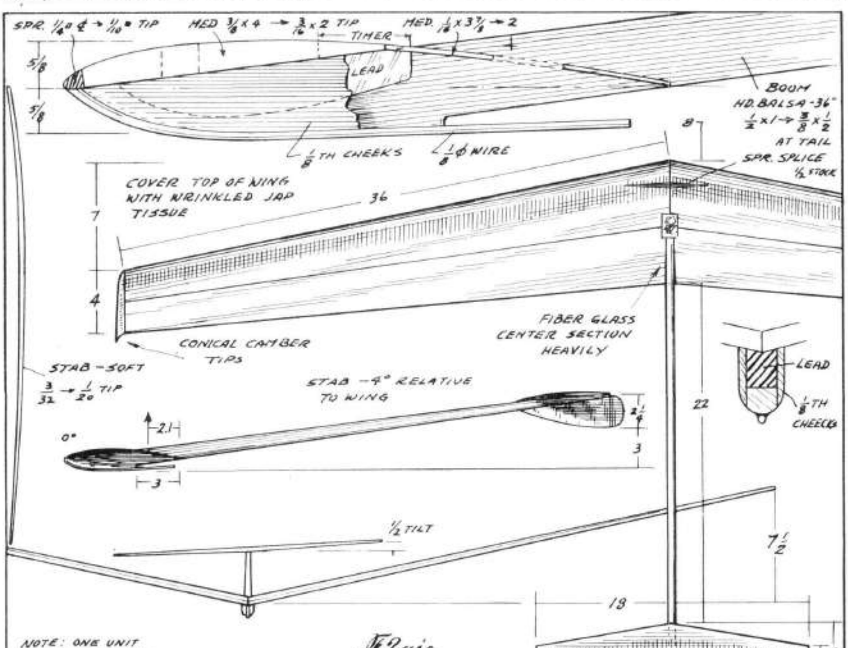
A-2 – DICK COLONNA – SEABROOK, TEX.



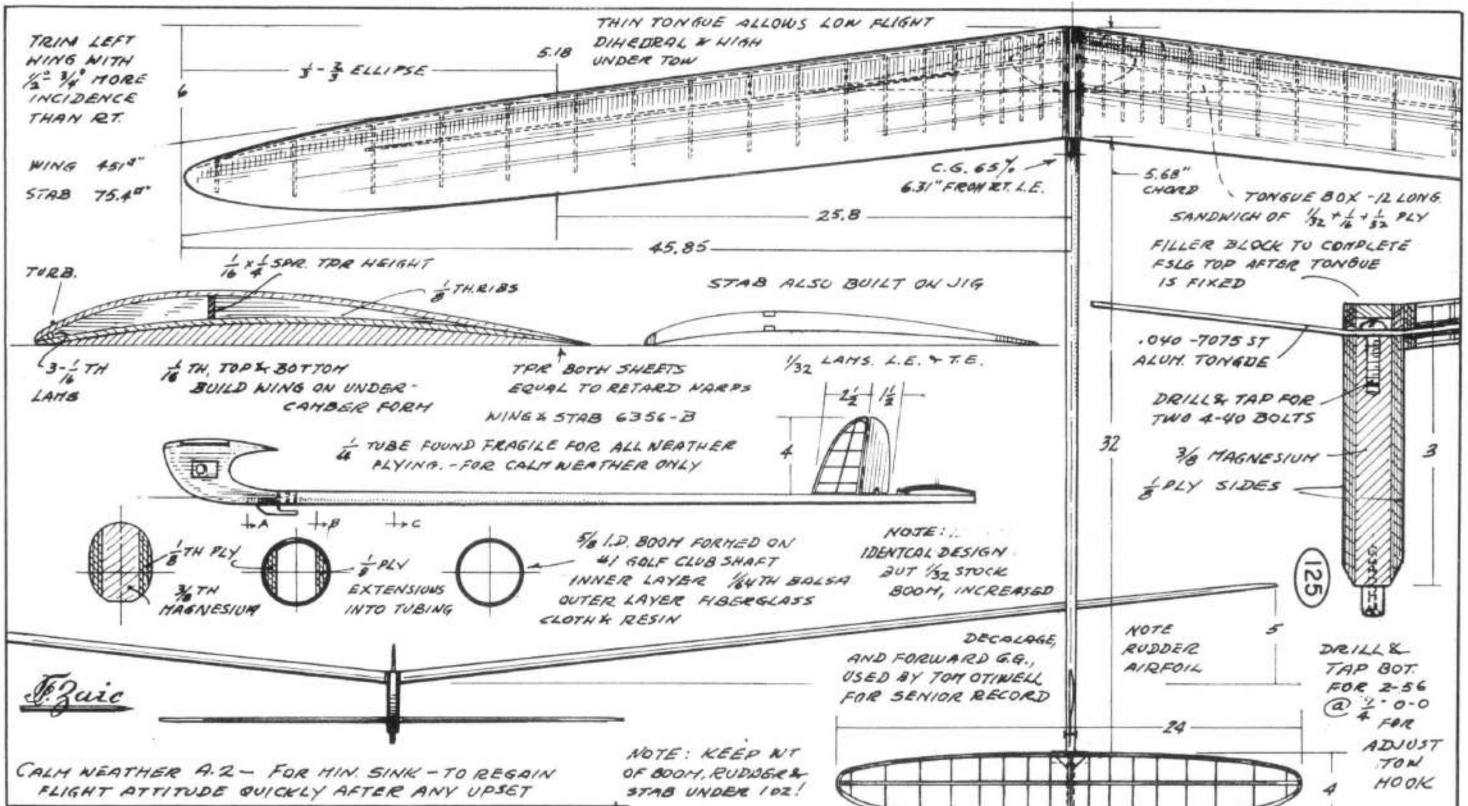
1964 A-2 NORDIC
ART FROST – ST. LOUIS, MO.



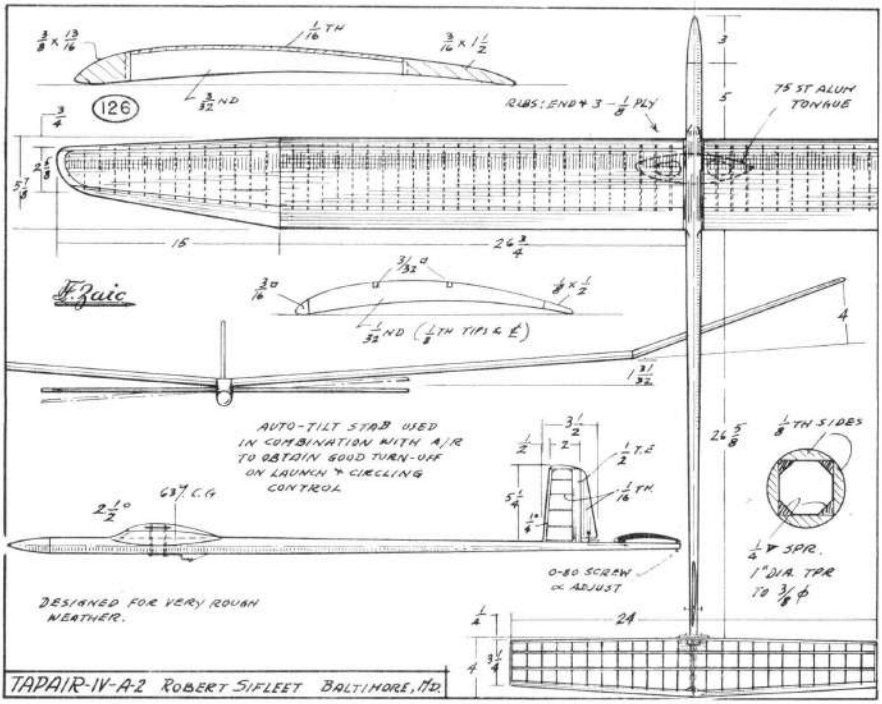
DESERT RAT A-2 NORDIC
HERMANN ANDRESEN - PHOENIX, ARIZ.



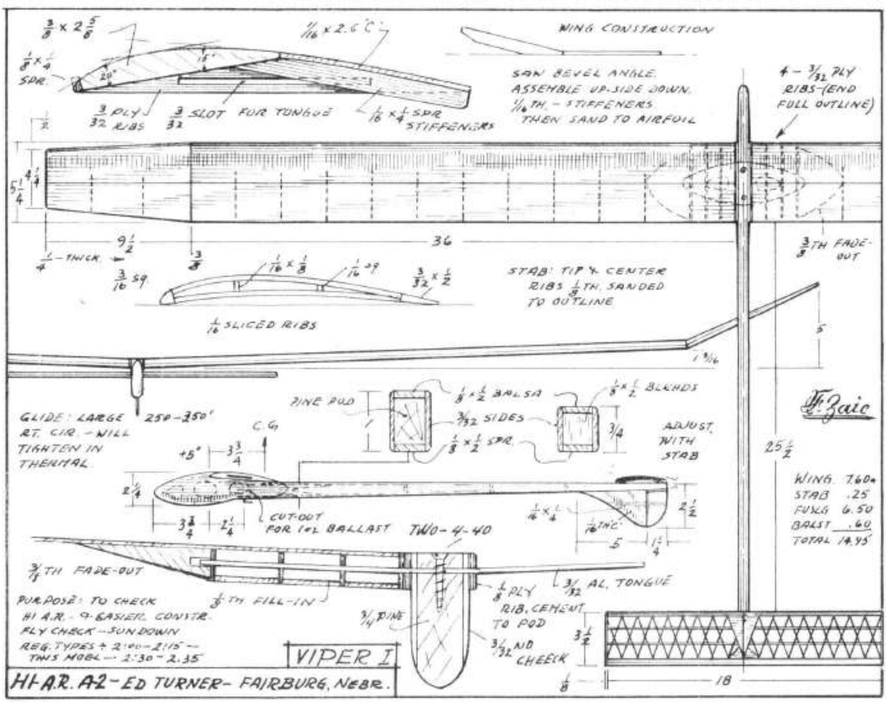
DUST DEVIL Mk III - HERMANN ANDRESEN - PHOENIX



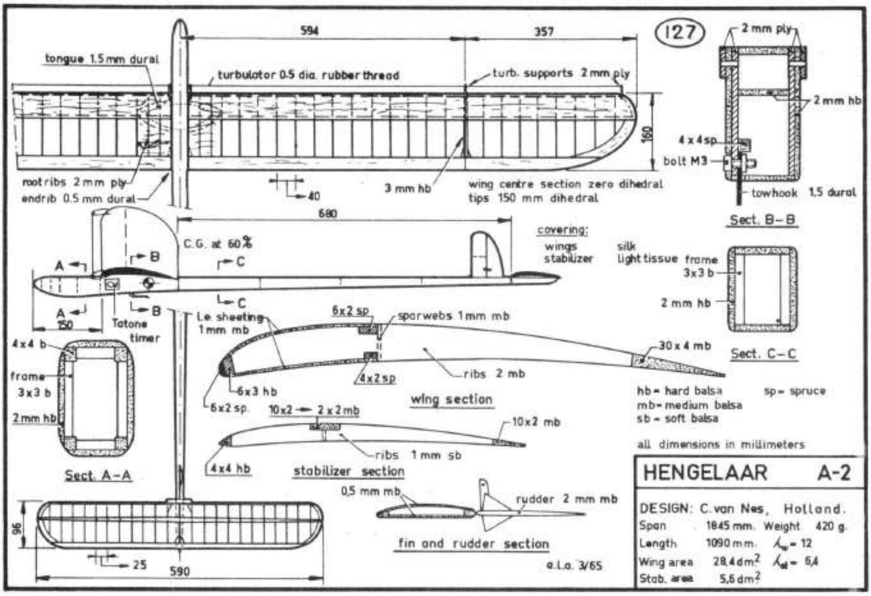
SISKIN III - LES HILL - SAN DIEGO, CALIF.

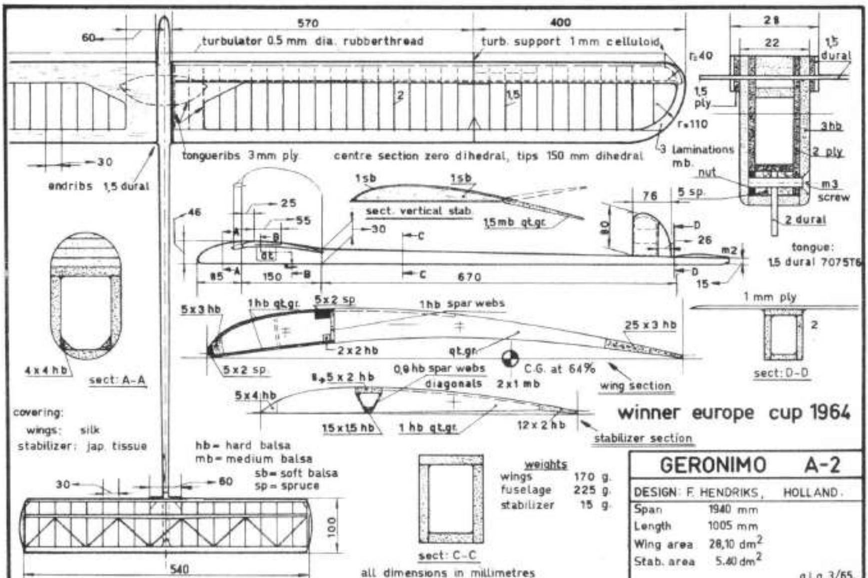


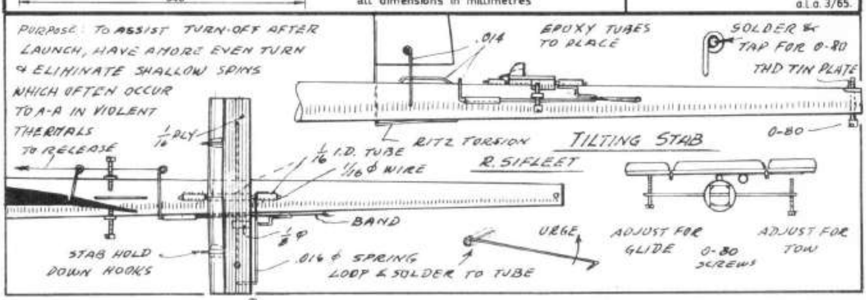
TAPAIR-IV-A-2 ROBERT SIFLEET BALTIMORE, MD.

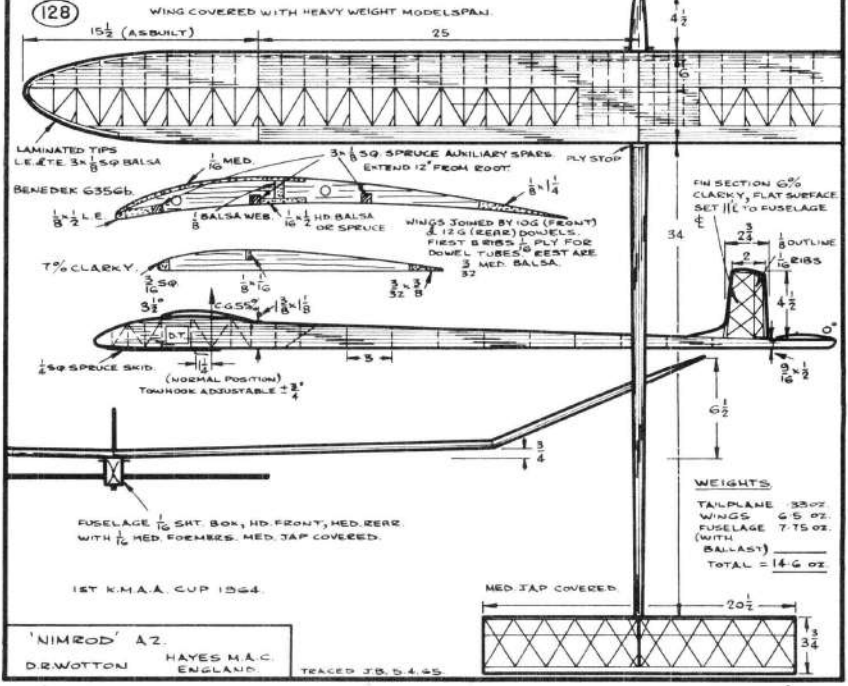


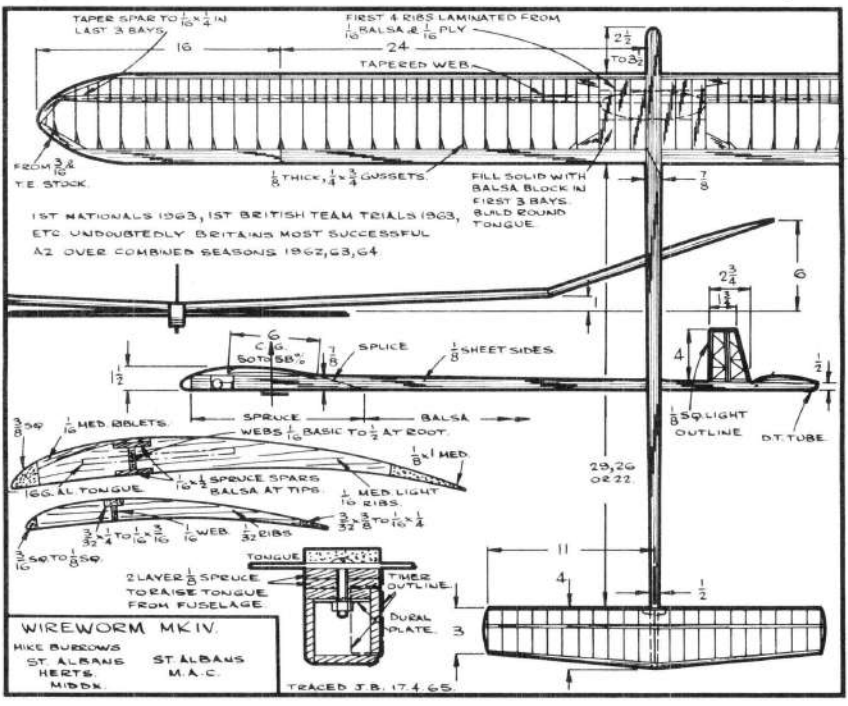
HI-A.R. A-2 - ED TURNER - FAIRBURG, NEBR.

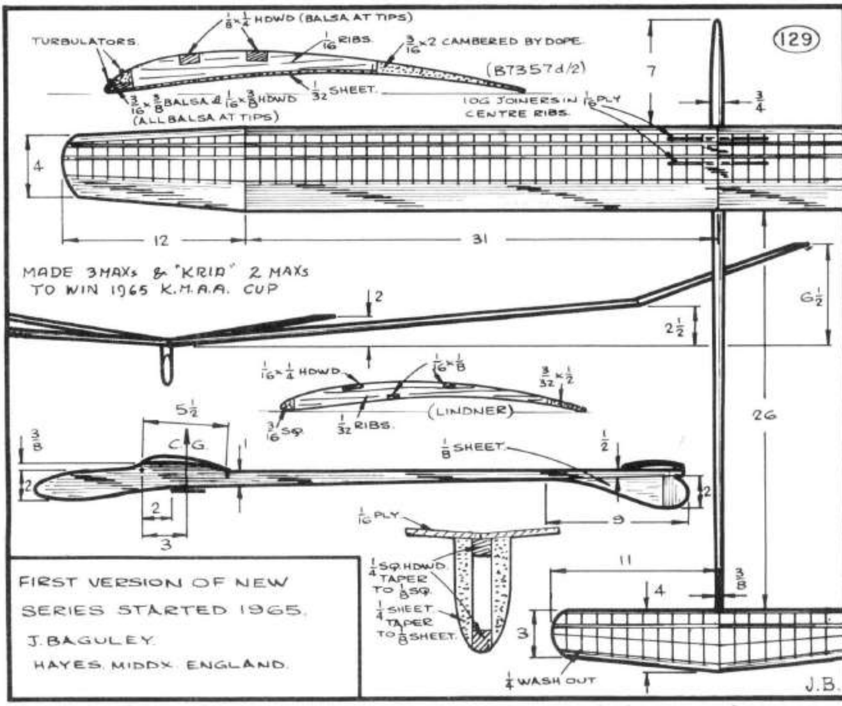

127
HENGELAAR A-2
DESIGN: C. van Nes, Holland.
Span 1845 mm. Weight 420 g.
Length 1090 mm.
Wing area 28,4 dm²
Stab. area 5,6 dm²
a.l.a. 3/65
tongue 1.5 mm dural
turbulator 0.5 dia. rubber thread
turb. supports 2 mm ply
root ribs 2 mm ply
endrib 0.5 mm dural
3 mm hb
wing centre section zero dihedral
tips 150 mm dihedral
C.G. at 60%
Tatone timer
covering:
wings silk
stabilizer light tissue
l.e. sheeting 1 mm mb
6x2 sp
sparwebs 1 mm mb
30 x 4 mb
6x3 hb
6x2 sp.
4x2 sp
ribs 2 mb
wing section
10x2
2 x 2 mb
10x2 mb
4x4 hb
ribs 1 mm sb
stabilizer section
0,5 mm mb
rudder 2 mm mb
fin and rudder section
4x4 b
frame 3x3 b
2mm hb
Sect. A-A
2 mm ply
2 mm hb
4 x 4 sp
bolt M3
towhook 1,5 dural
Sect. B-B
frame 3x3 b
2 mm hb
Sect. C-C
hb = hard balsa
mb = medium balsa
sb = soft balsa
sp = spruce
all dimensions in millimeters

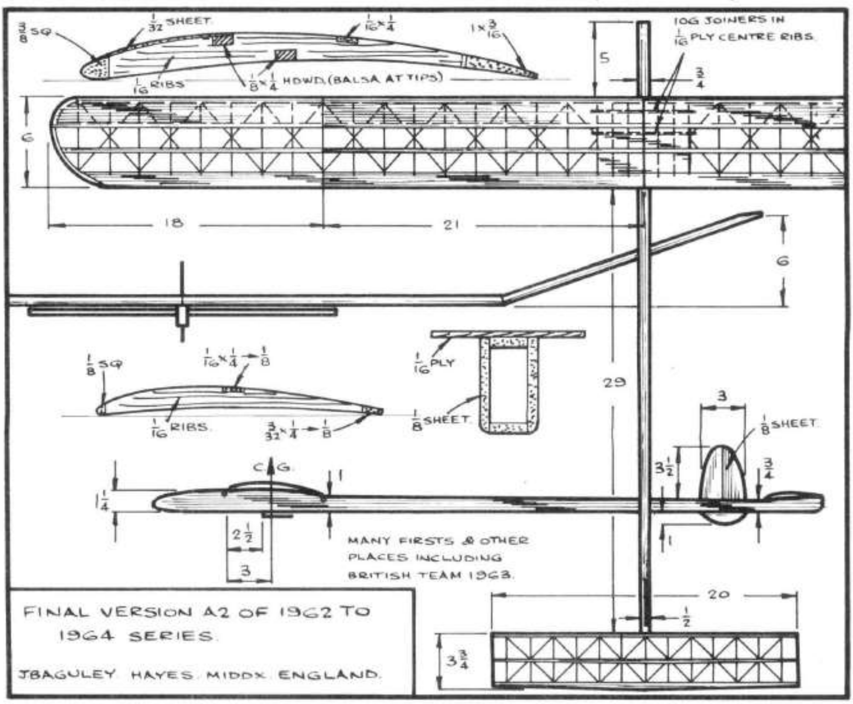

GERONIMO A-2
DESIGN: F. HENDRIKS, HOLLAND.
Span 1940 mm
Length 1005 mm
Wing area 28,10 dm²
Stab. area 5.40 dm²
a.l.a. 3/65
winner europe cup 1964
turbulator 0.5 mm dia. rubberthread
turb. support 1 mm celluloid
tongueribs 3 mm ply
centre section zero dihedral, tips 150 mm dihedral
endribs 1,5 dural
3 laminations mb.
sect. vertical stab
1,5 mb qt.gr.
5 x3 hb
1hb qt.gr.
5x2 sp
1hb spar webs
25 x 3 hb
2x2 hb
5x2 sp
C.G. at 64%
wing section
0,9 hb spar webs
diagonals 2x1 mb
5x4 hb
15x1,5 hb
1 hb qt.gr.
12x2 hb
stabilizer section
4x4 hb
sect: A-A
covering:
wings: silk
stabilizer: jap. tissue
hb = hard balsa
mb = medium balsa
sb = soft balsa
sp = spruce
weights
wings 170 g.
fuselage 225 g.
stabilizer 15 g.
sect: C-C
1,5 dural
1,5 ply
3 hb
2 ply
nut
m3 screw
2 dural
tongue: 1,5 dural 7075T6
1 mm ply
sect: D-D
all dimensions in millimetres

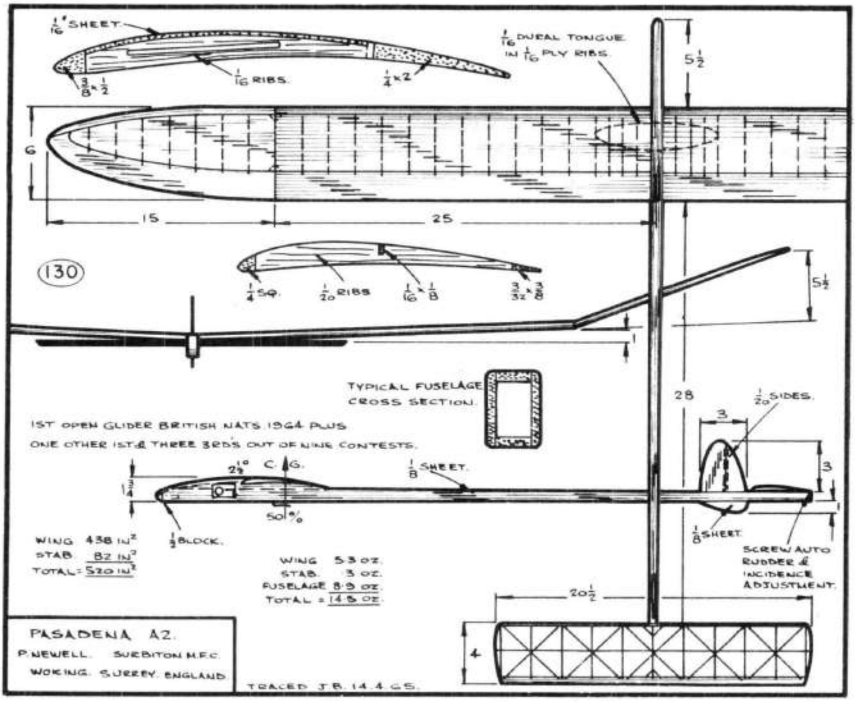

PURPOSE: TO ASSIST TURN-OFF AFTER LAUNCH, HAVE A MORE EVEN TURN & ELIMINATE SHALLOW SPINS WHICH OFTEN OCCUR TO A-A IN VIOLENT THERMALS
TO RELEASE
.014
EPOXY TUBES TO PLACE
SOLDER & TAP FOR 0-80 THD TIN PLATE
1/16 PLY
1/16 I.D. TUBE
1/16 φ WIRE
RITZ TORSION
TILTING STAB
R. SIFLEET
0-80
BAND
1/8 φ
STAB HOLD DOWN HOOKS
.016 φ SPRING
LOOP & SOLDER TO TUBE
URGE
ADJUST FOR GLIDE
0-80 SCREWS
ADJUST FOR TOW


128
WING COVERED WITH HEAVY WEIGHT MODELSPAN.
15½ (AS BUILT)
25
4½
6
LAMINATED TIPS
L.E. & T.E. 3×⅛ SQ BALSA
1/16 MED.
3×⅛ SQ. SPRUCE AUXILIARY SPARS
EXTEND 12" FROM ROOT
PLY STOP
BENEDEK 6356b.
⅛×1¼
⅛×½ L.E.
⅛ BALSA WEB.
1/16×½ HD BALSA OR SPRUCE
WINGS JOINED BY 10G (FRONT) & 12G (REAR) DOWELS. FIRST 8 RIBS 1/16 PLY FOR DOWEL TUBES. REST ARE 3/32 MED. BALSA.
FIN SECTION 6% CLARKY, FLAT SURFACE SET ||ℓ TO FUSELAGE ℄
34
2¾
⅛ OUTLINE
1/16 RIBS
7% CLARKY.
3/16 SQ.
⅛×1/16
3/32×⅜
3½°
C.G. 55%
1⅜×1⅛
D.T.
4½
0°
¼ SQ. SPRUCE SKID.
(NORMAL POSITION)
TOWHOOK ADJUSTABLE ±¾"
3
9/16×½
6½
¾
FUSELAGE 1/16 SHT. BOX, HD. FRONT, MED. REAR. WITH 1/16 MED. FORMERS. MED. JAP COVERED.
WEIGHTS.
TAILPLANE .33 OZ.
WINGS 6.5 OZ.
FUSELAGE (WITH BALLAST) 7.75 OZ.
TOTAL = 14.6 OZ.
1ST K.M.A.A. CUP 1964.
MED. JAP COVERED.
20½
3¾
'NIMROD' A2.
D.R. WOTTON
HAYES M.A.C. ENGLAND.
TRACED J.B. 5.4.65.

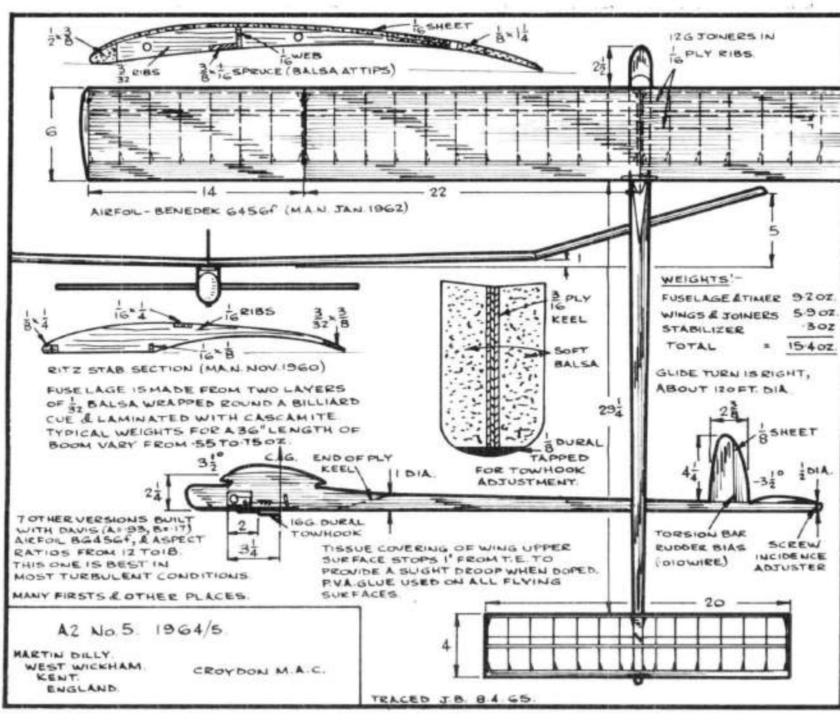

TAPER SPAR TO 1/16×¼ IN LAST 3 BAYS.
FIRST 4 RIBS LAMINATED FROM 1/16 BALSA & 1/16 PLY
2½
TO 3½
16
24
TAPERED WEB.
FROM 3/16 & T.E. STOCK.
⅛ THICK, ¼×¾ GUSSETS.
FILL SOLID WITH BALSA BLOCK IN FIRST 3 BAYS. BUILD ROUND TONGUE.
⅞
1ST NATIONALS 1963, 1ST BRITISH TEAM TRIALS 1963, ETC. UNDOUBTEDLY BRITAINS MOST SUCCESSFUL A2 OVER COMBINED SEASONS 1962, 63, 64.
2¾
6
1¾
1
6
C.G. 50 TO 58%
⅞
SPLICE
⅛ SHEET SIDES.
4
1½
½
SPRUCE
BALSA
⅛ SQ. LIGHT OUTLINE
D.T. TUBE.
⅜ SQ
1/16 MED. RIBLETS.
WEBS 1/16 BASIC TO ½ AT ROOT.
⅛×1 MED.
16G. AL. TONGUE
1/16×½ SPRUCE SPARS BALSA AT TIPS.
1/16 MED. LIGHT RIBS.
29, 26 OR 22.
3/32×¼ TO 1/16×3/16
1/16 WEB.
1/32 RIBS
3/32×⅜ TO 1/16×¼
3/16 SQ. TO ⅛ SQ.
TONGUE
11
2 LAYER ⅛ SPRUCE TO RAISE TONGUE FROM FUSELAGE.
TIMER OUTLINE.
4
½
DURAL PLATE.
3
WIREWORM MK IV.
MIKE BURROWS
ST. ALBANS HERTS.
MIDDX.
ST. ALBANS M.A.C.
TRACED J.B. 17.4.65.


129
TURBULATORS
1/8 × 1/4 HDWD (BALSA AT TIPS)
1/16 RIBS
3/16 × 2 CAMBERED BY DOPE
(B7357d/2)
3/16 × 3/8 BALSA & 1/16 × 3/8 HDWD
(ALL BALSA AT TIPS)
1/32 SHEET
10G JOINERS IN 1/8 PLY CENTRE RIBS
MADE 3 MAXs & "KRIA" 2 MAXs
TO WIN 1965 K.M.A.A. CUP
1/16 × 1/4 HDWD
1/16 × 1/8
3/32 × 1/2
(LINDNER)
3/16 SQ.
1/32 RIBS
C.G.
1/8 SHEET
1/16 PLY
1/4 SQ. HDWD. TAPER TO 1/8 SQ.
1/4 SHEET TAPER TO 1/8 SHEET
FIRST VERSION OF NEW
SERIES STARTED 1965.
J. BAGULEY.
HAYES. MIDDX. ENGLAND.
1/4 WASH OUT
J.B.

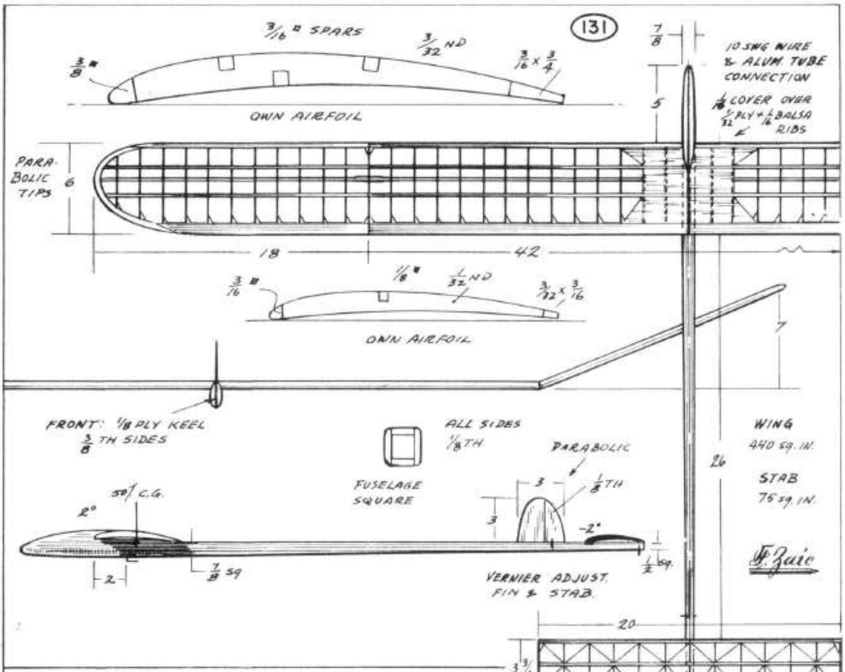

3/8 SQ.
1/32 SHEET
1/16 × 1/4
1 × 3/16
10G JOINERS IN 1/16 PLY CENTRE RIBS
1/16 RIBS
1/8 × 1/4 HDWD. (BALSA AT TIPS)
1/8 SQ
1/16 × 1/4 → 1/8
1/16 PLY
1/16 RIBS
3/32 × 1/4 → 1/8
1/8 SHEET
C.G.
MANY FIRSTS & OTHER
PLACES INCLUDING
BRITISH TEAM 1963.
FINAL VERSION A2 OF 1962 TO
1964 SERIES.
J BAGULEY. HAYES. MIDDX. ENGLAND.



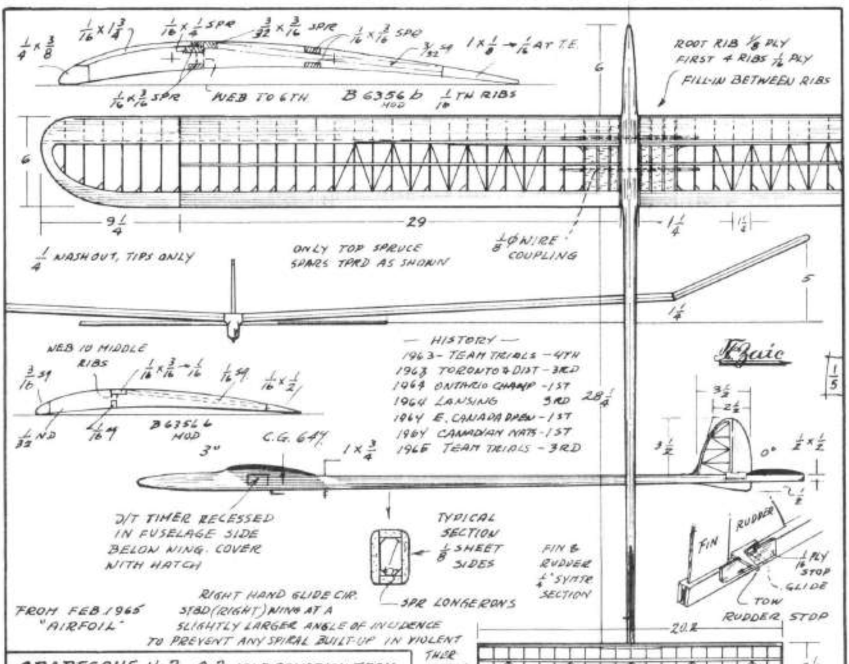
1/16" SHEET
3/8 x 1/2
1/16 RIBS
1/4 x 2
1/16 DURAL TONGUE IN 1/16 PLY RIBS
5 1/2
6
15
25
130
1/4 SQ.
1/20 RIBS
1/16 x 1/8
3/32 x 3/8
5 1/2
1
TYPICAL FUSELAGE CROSS SECTION.
28
1/20 SIDES.
3
IST OPEN GLIDER BRITISH NATS 1964 PLUS
ONE OTHER IST & THREE 3RD'S OUT OF NINE CONTESTS.
2 1/2° C.G.
1/8 SHEET.
3
1 3/4
50%
1/2 BLOCK.
1/8 SHEET
WING 438 IN²
STAB. 82 IN²
TOTAL: 520 IN²
WING 5.3 OZ.
STAB. 3 OZ.
FUSELAGE 8.9 OZ.
TOTAL = 14.5 OZ.
SCREW AUTO RUDDER & INCIDENCE ADJUSTMENT.
20 1/2
4
PASADENA A2.
P. NEWELL. SURBITON M.F.C.
WOKING. SURREY. ENGLAND.
TRACED J.B. 14.4.65.



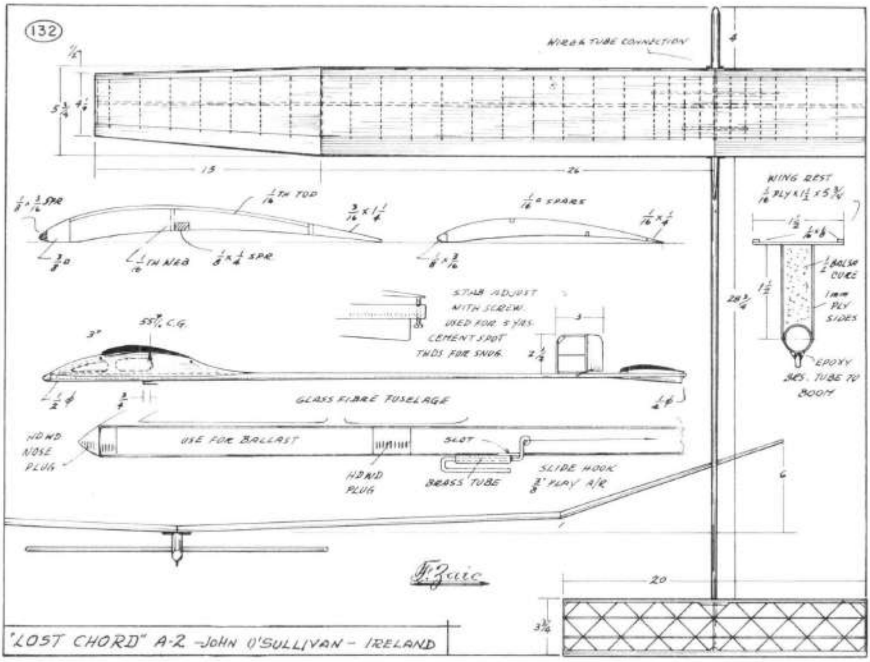
1/2 x 3/8
1/16 SHEET
1/8 x 1 1/4
3/32 RIBS
1/16 WEB
3/8 x 1/16 SPRUCE (BALSA AT TIPS)
12 G JOINERS IN 1/16 PLY RIBS.
2 1/2
6
14
22
AIRFOIL - BENEDEK 6456f (M.A.N. JAN. 1962)
5
1
WEIGHTS:-
FUSELAGE & TIMER 9.2 OZ.
WINGS & JOINERS 5.9 OZ.
STABILIZER .3 OZ
TOTAL = 15.4 OZ.
1/8 x 1/4
1/16 x 1/4
1/16 RIBS
3/32 x 3/8
1/16 x 1/8
3/16 PLY KEEL
SOFT BALSA
RITZ STAB. SECTION (M.A.N. NOV. 1960)
GLIDE TURN IS RIGHT, ABOUT 120 FT. DIA.
FUSELAGE IS MADE FROM TWO LAYERS OF 1/32 BALSA WRAPPED ROUND A BILLIARD CUE & LAMINATED WITH CASCAMITE. TYPICAL WEIGHTS FOR A 36" LENGTH OF BOOM VARY FROM .55 TO .75 OZ.
29 1/4
2 3/8
1/8 SHEET
1/8 DURAL TAPPED FOR TOWHOOK ADJUSTMENT.
3 1/2°
C.G.
END OF PLY KEEL
1 DIA.
4 1/4
-3 1/2°
1/2 DIA.
2 1/4
7 OTHER VERSIONS BUILT WITH DAVIS (A: 93, B: 17) AIRFOIL 6456f, & ASPECT RATIOS FROM 12 TO 18. THIS ONE IS BEST IN MOST TURBULENT CONDITIONS.
2
3 1/4
16G. DURAL TOWHOOK
TISSUE COVERING OF WING UPPER SURFACE STOPS 1" FROM T.E. TO PROVIDE A SLIGHT DROOP WHEN DOPED. P.V.A. GLUE USED ON ALL FLYING SURFACES.
TORSION BAR RUDDER BIAS (010 WIRE)
SCREW INCIDENCE ADJUSTER
MANY FIRSTS & OTHER PLACES.
20
4
A2 No. 5. 1964/5.
MARTIN DILLY.
WEST WICKHAM.
KENT.
ENGLAND.
CROYDON M.A.C.
TRACED J.B. 8.4.65.

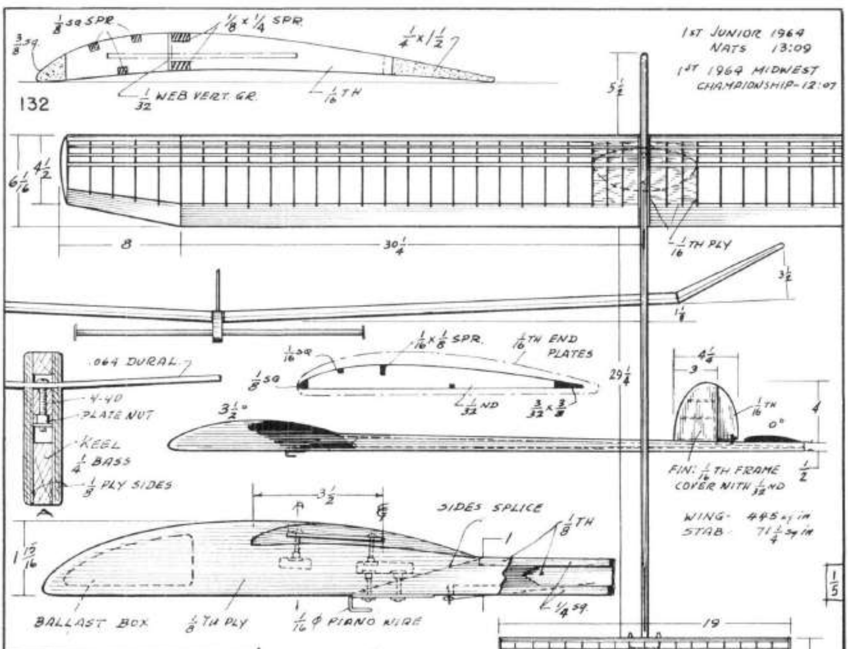


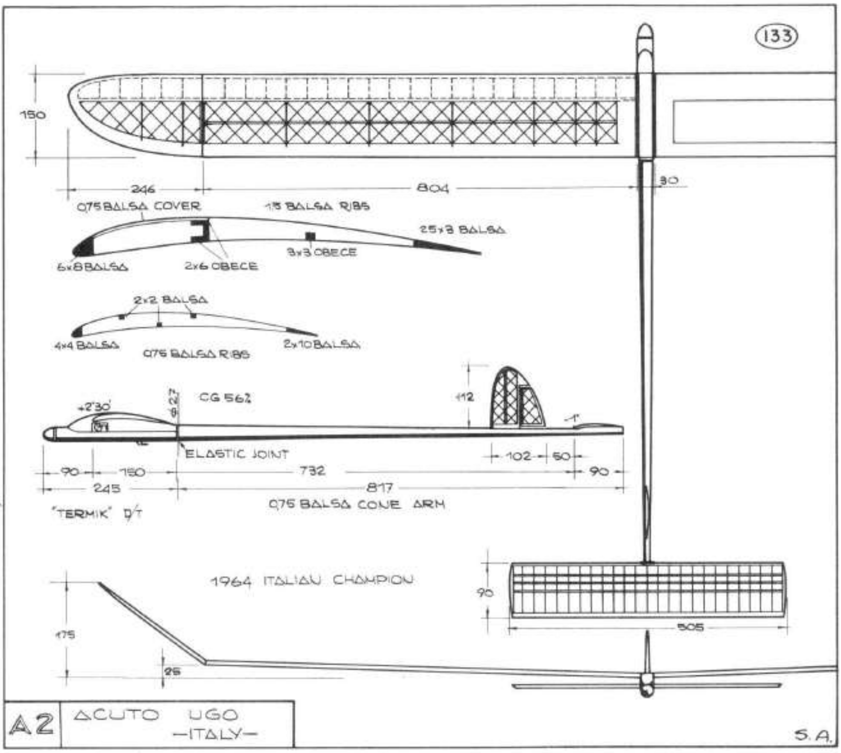
65-WICHITA-S A-2. MIKE WOODHOUSE. ENGLAND

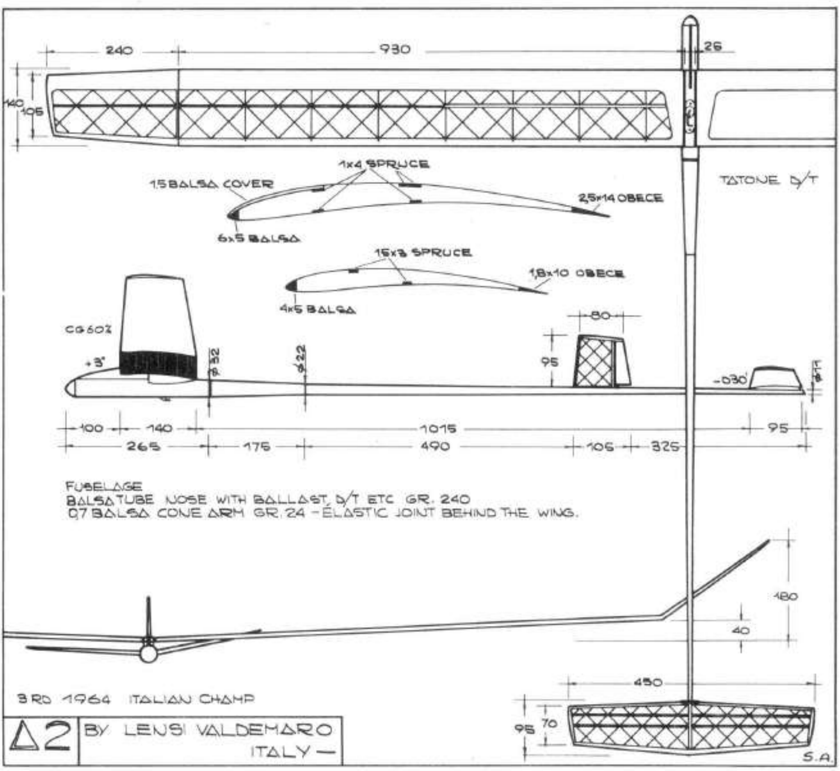


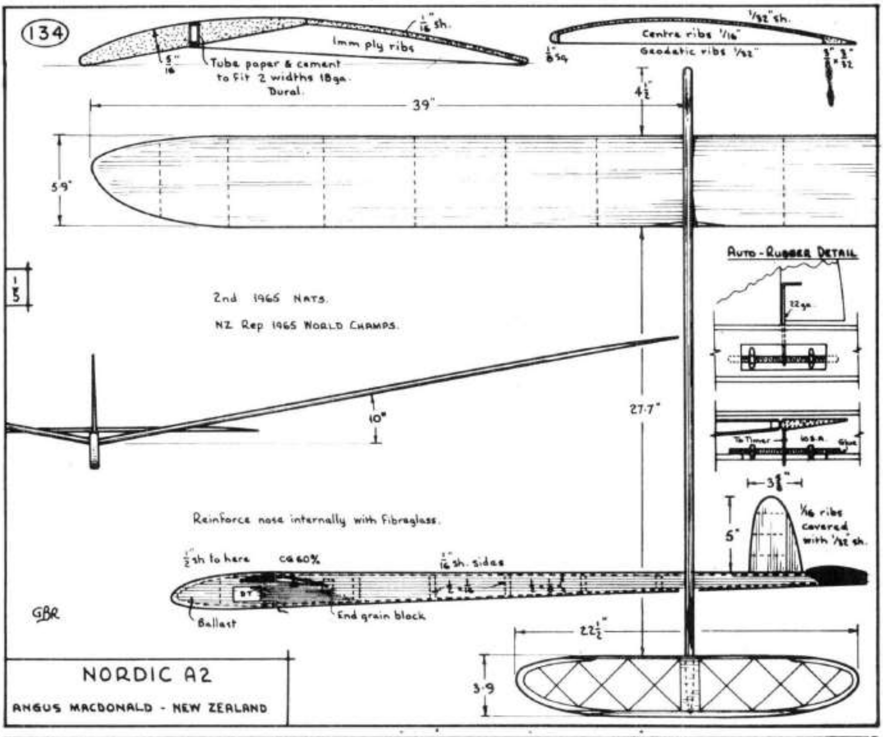
ARABESQUE No2 - A•2 - 1965 CANADIAN TEAM
BY P. J. ALLNUTT — CANADA

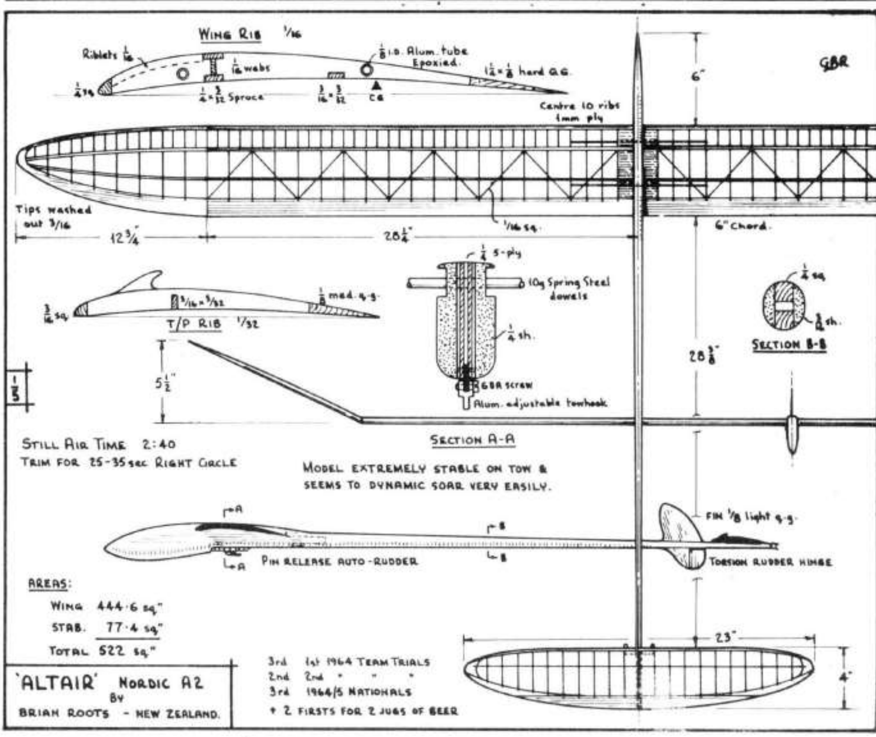

132
WIRE & TUBE CONNECTION
WING REST
1mm PLY SIDES
EPOXY BRS. TUBE TO BOOM
STAB ADJUST WITH SCREW. USED FOR 5 YRS. CEMENT SPOT THUS FOR SNUG.
55% C.G.
GLASS FIBRE FUSELAGE
HDWD. NOSE PLUG
USE FOR BALLAST
SLOT
HDWD. PLUG
BRASS TUBE
SLIDE HOOK
"LOST CHORD" A-2 – JOHN O'SULLIVAN – IRELAND

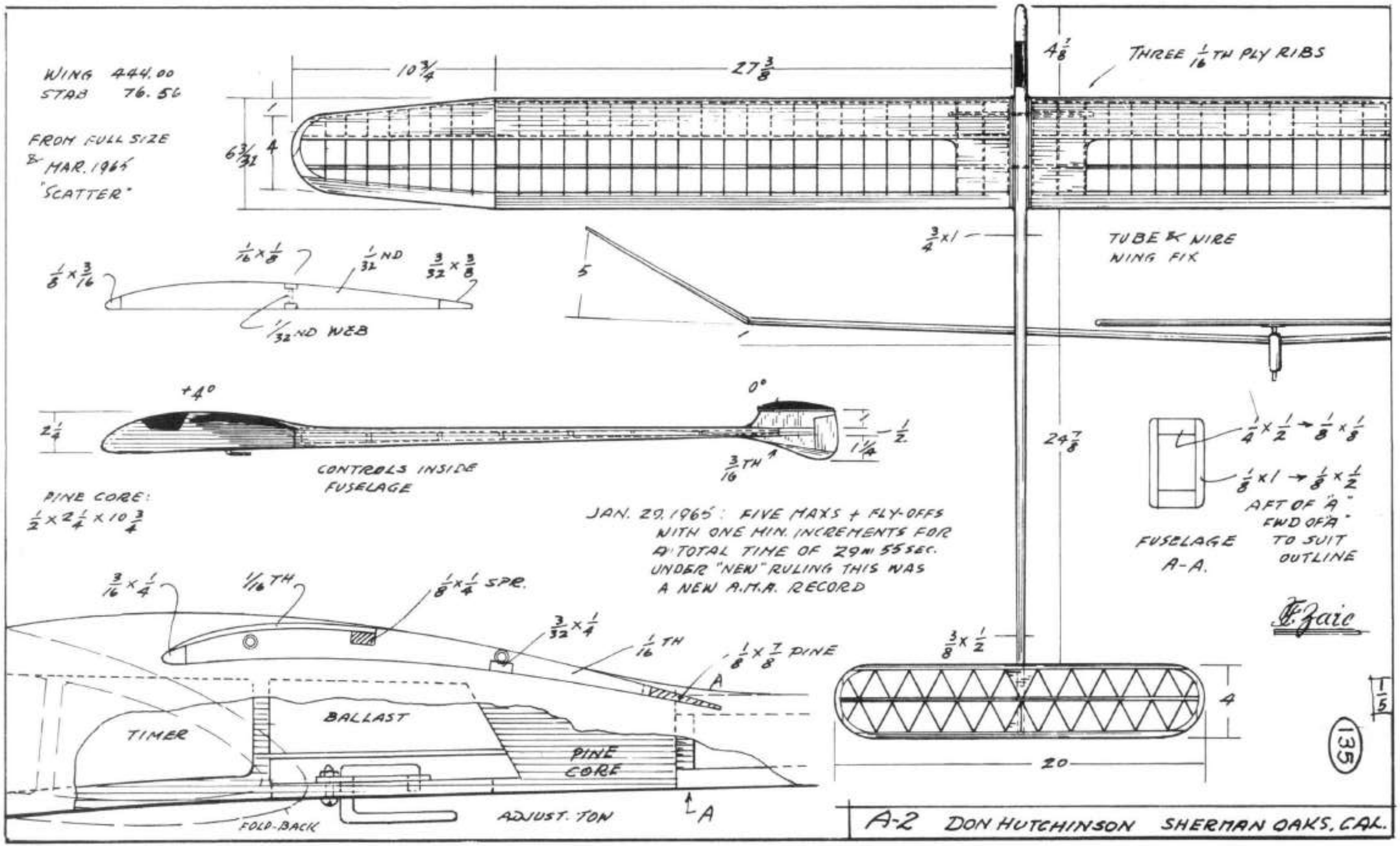

1ST JUNIOR 1964 NATS 13:09
1ST 1964 MIDWEST CHAMPIONSHIP – 12:07
132
.064 DURAL
4-40 PLATE NUT
KEEL
SIDES SPLICE
BALLAST BOX
A-2 NORDIC "SNOOPY"
DICK MONTS – WICHITA, KANS.


133
150
246
804
30
0,75 BALSA COVER
1,5 BALSA RIBS
25x3 BALSA
3x3 OBECE
6x8 BALSA
2x6 OBECE
2x2 BALSA
4x4 BALSA
0,75 BALSA RIBS
2x10 BALSA
+2°30'
CG 56%
112
-1°
ELASTIC JOINT
102
50
70
150
732
90
245
817
"TERMIK" D/T
0,75 BALSA CONE ARM
1964 ITALIAN CHAMPION
90
505
175
25
A2
ACUTO UGO
—ITALY—
S.A.

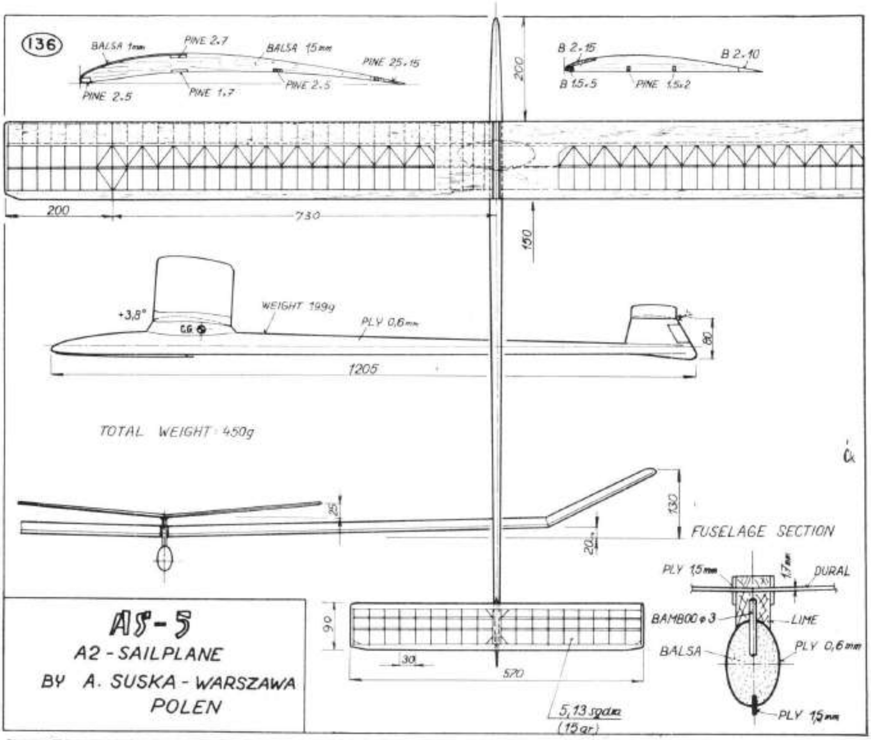

240
930
26
140
105
1x4 SPRUCE
1,5 BALSA COVER
TATONE D/T
2,5x14 OBECE
6x5 BALSA
15x3 SPRUCE
1,8x10 OBECE
4x5 BALSA
80
CG 60%
+3°
95
-0°30'
100
140
1015
95
265
175
490
105
325
FUSELAGE
BALSATUBE NOSE WITH BALLAST, D/T ETC GR. 240
0,7 BALSA CONE ARM GR. 24 - ELASTIC JOINT BEHIND THE WING.
180
40
450
3 RD 1964 ITALIAN CHAMP
A2
BY LENSI VALDEMARO
ITALY —
95
70
S.A.

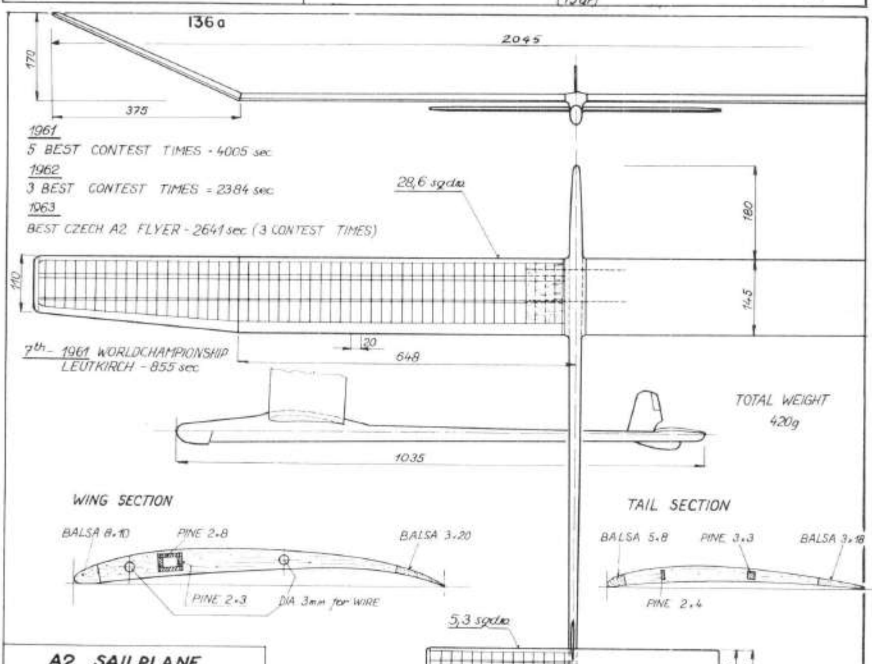

134
1/16" sh.
1mm ply ribs
5/16"
Tube paper & cement to fit 2 widths 18ga. Dural.
1/32" sh.
Centre ribs 1/16"
Geodetic ribs 1/32"
1/8 sq.
3/8" x 3/32"
39"
4 1/2"
5.9"
2nd 1965 NATS.
NZ Rep 1965 WORLD CHAMPS.
AUTO-RUDDER DETAIL
22ga.
To Timer
10s A
Glue
3 3/8"
10"
27.7"
5"
1/16 ribs covered with 1/32" sh.
Reinforce nose internally with fibreglass.
1/2" sh to here
CG 60%
1/16" sh. sides
Ballast
End grain block
GBR
22 1/2"
3.9
NORDIC A2
ANGUS MACDONALD - NEW ZEALAND

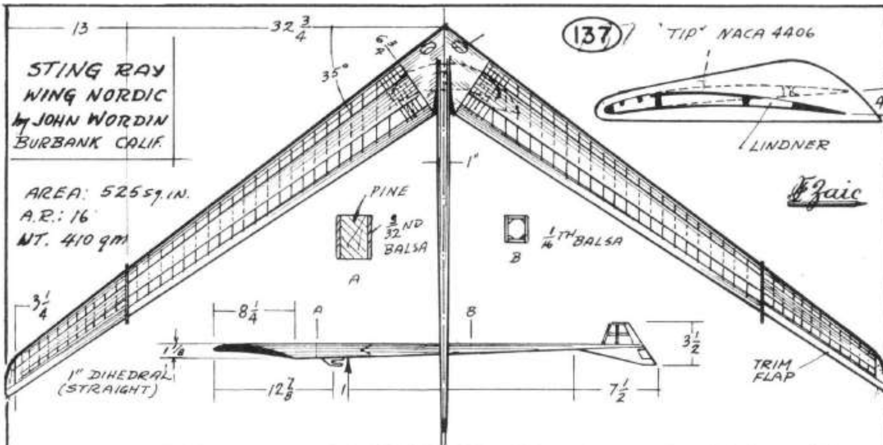

WING RIB 1/16
Riblets 1/16
1/16 webs
1/8 i.d. Alum. tube Epoxied.
1/2 x 1/8 hard a.g.
1/4 sq.
1/4 x 3/32 Spruce
3/16 x 3/32
CG
6"
GBR
Centre 10 ribs 1mm ply
Tips washed out 3/16
12 3/4
28 1/4"
1/16 sq.
6" Chord.
1/4 5-ply
10g Spring Steel dowels
3/16 sq.
3/16 x 3/32
1/8 med. a.g.
T/P RIB 1/32
1/4 sh.
6BA screw
Alum. adjustable towhook
1/4 sq.
1/8 sh.
SECTION B-B
5 1/2"
28 3/8"
STILL AIR TIME 2:40
TRIM FOR 25-35 sec RIGHT CIRCLE
SECTION A-A
MODEL EXTREMELY STABLE ON TOW & SEEMS TO DYNAMIC SOAR VERY EASILY.
FIN 1/8 light a.g.
PIN RELEASE AUTO-RUDDER
TORSION RUDDER HINGE
AREAS:
WING 444.6 sq"
STAB. 77.4 sq"
TOTAL 522 sq"
23"
4"
3rd 1st 1964 TEAM TRIALS
2nd 2nd " "
3rd 1964/5 NATIONALS
+ 2 FIRSTS FOR 2 JUGS OF BEER
'ALTAIR' NORDIC A2 BY BRIAN ROOTS - NEW ZEALAND.



WING 444.00
STAB 76.56
FROM FULL SIZE
& MAR. 1965
"SCATTER"
10 3/4
27 3/8
4 1/8
THREE 1/16 TH PLY RIBS
6 3/32
4
1
1/8 x 3/16
1/16 x 1/8
1/32 ND
3/32 x 3/8
1/32 ND WEB
5
3/4 x 1
TUBE & WIRE
WING FIX
+4°
0°
2 1/4
1 1/4
1/2
3/16 TH
CONTROLS INSIDE
FUSELAGE
24 7/8
1/4 x 1/2 → 1/8 x 1/8
1/8 x 1 → 1/8 x 1/2
AFT OF "A"
FWD OF "A"
TO SUIT
OUTLINE
FUSELAGE
A-A.
PINE CORE:
1/2 x 2 1/4 x 10 3/4
JAN. 29, 1965: FIVE MAXS + FLY-OFFS
WITH ONE MIN. INCREMENTS FOR
A TOTAL TIME OF 29 MI 55 SEC.
UNDER "NEW" RULING THIS WAS
A NEW A.M.A. RECORD
F. Zaic
3/16 x 1/4
1/16 TH
1/8 x 1/4 SPR.
3/32 x 1/4
1/16 TH
1/8 x 7/8 PINE
A
3/8 x 1/2
BALLAST
TIMER
PINE
CORE
ADJUST. TOW
FOLD-BACK
A
20
4
1/5
135
A-2 DON HUTCHINSON SHERMAN OAKS, CAL.


136
BALSA 1mm
PINE 2.7
BALSA 15mm
PINE 25.15
PINE 2.5
PINE 1.7
PINE 2.5
B 2.15
B 2.10
B 1.5.5
PINE 1.5.2
200
200
730
150
+3,8°
WEIGHT 199g
PLY 0,6mm
C.G.
80
1205
TOTAL WEIGHT 450g
25
130
20
FUSELAGE SECTION
PLY 1,5mm
1,7mm
DURAL
BAMBOO ø 3
LIME
BALSA
PLY 0,6mm
PLY 1,5mm
90
30
570
5,13 sqdm
(15 gr.)
AS-5
A2 - SAILPLANE
BY A. SUSKA - WARSZAWA
POLEN

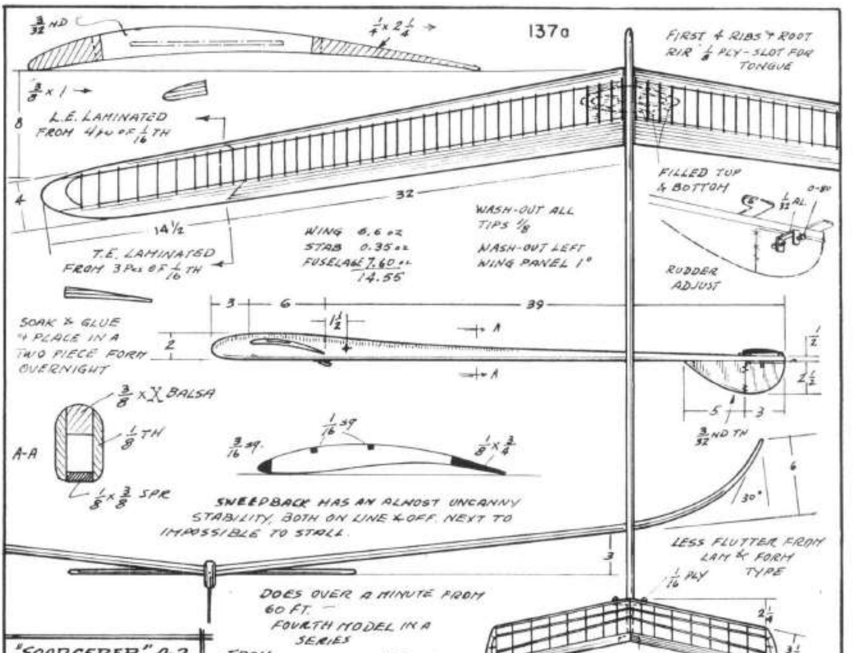

136 a
170
2045
375
1961
5 BEST CONTEST TIMES - 4005 sec
1962
3 BEST CONTEST TIMES = 2384 sec
1963
BEST CZECH A2 FLYER - 2641 sec (3 CONTEST TIMES)
28,6 sqdm
180
110
145
20
648
7th - 1961 WORLDCHAMPIONSHIP
LEUTKIRCH - 855 sec
TOTAL WEIGHT
420g
1035
WING SECTION
BALSA 8.10
PINE 2.8
BALSA 3.20
PINE 2.3
DIA 3mm for WIRE
TAIL SECTION
BALSA 5.8
PINE 3.3
BALSA 3.18
PINE 2.4
5,3 sqdm
75
100
240
570
A2 SAILPLANE
BY MICHAL HLUBOCKÝ
CZECHOSLOWAKIA

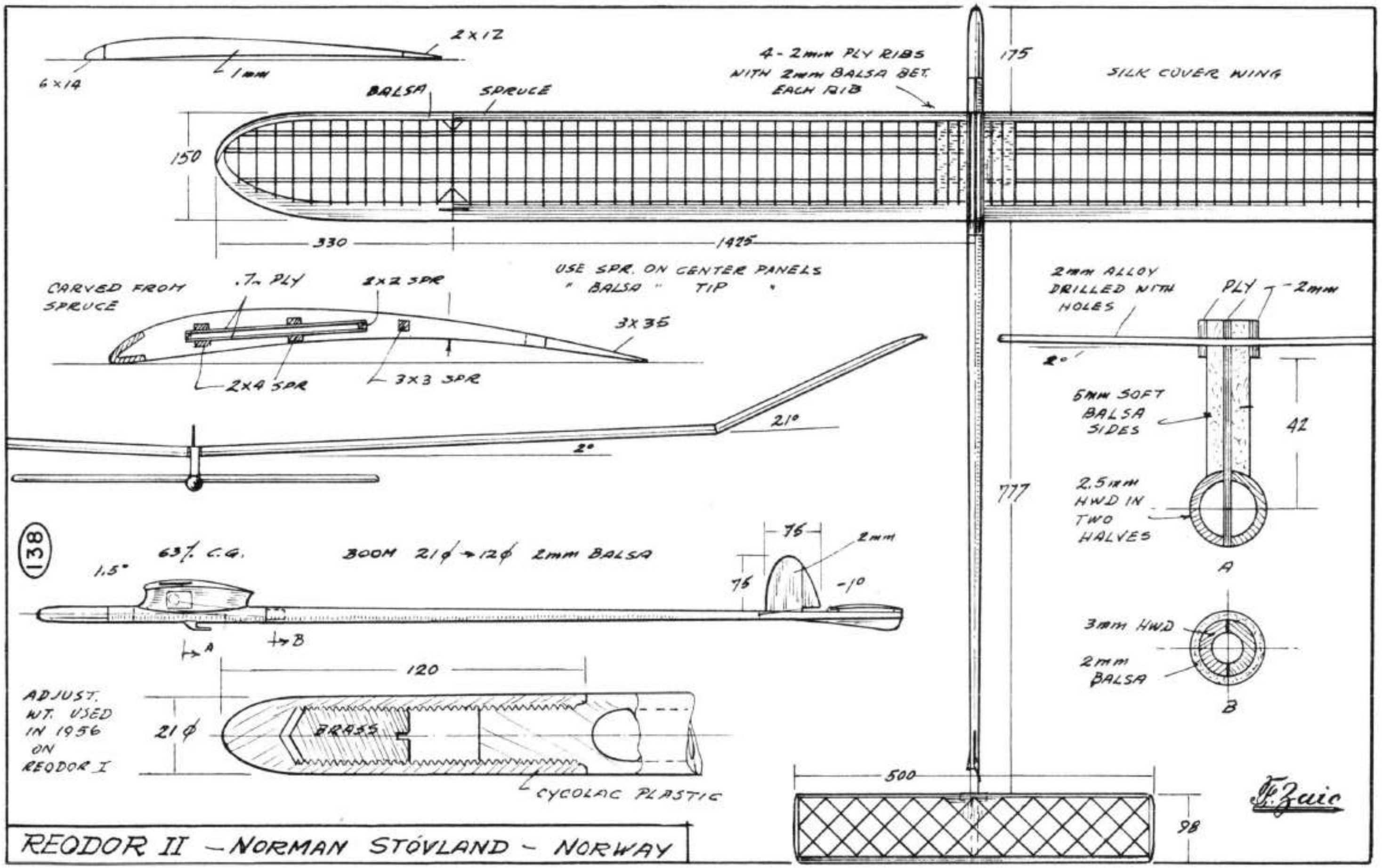


"STING RAY" has an ancestor in the "Sailwing 50".--A large Aspect Ratio and Lindner airfoil were selected to obtain minimum sink. Rudder was placed on a long boom to obtain better leverage and keep it from being blanketed by the wing. Overhead tows are effortless with sweepback and rudder on boom.

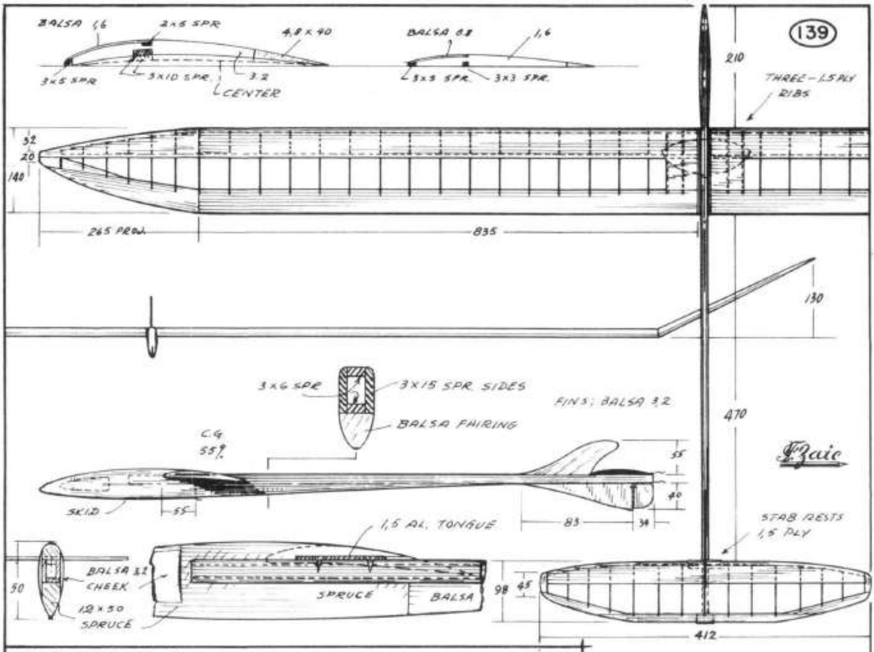
Major problem with this wing was warping. Although structure worked well as anti-warp on 25 wings and stabs of conventional type, it did not work well on the wing because the ribs were not perpendicular to the spars.

Flaps set into the fuselage were used for D/T. The flaps flipped forward and were supposed to cause enough drag to bring the model down. This method was tested on H. L. Gliders on which 5% of wing area was enough to bring the model down. However, on the wing 5% was not enough. More was required. Perhaps if the flaps would also cover part of the wing to kill lift, better results would be obtained. More experimental work is needed to find a good D/T for the flying wing.

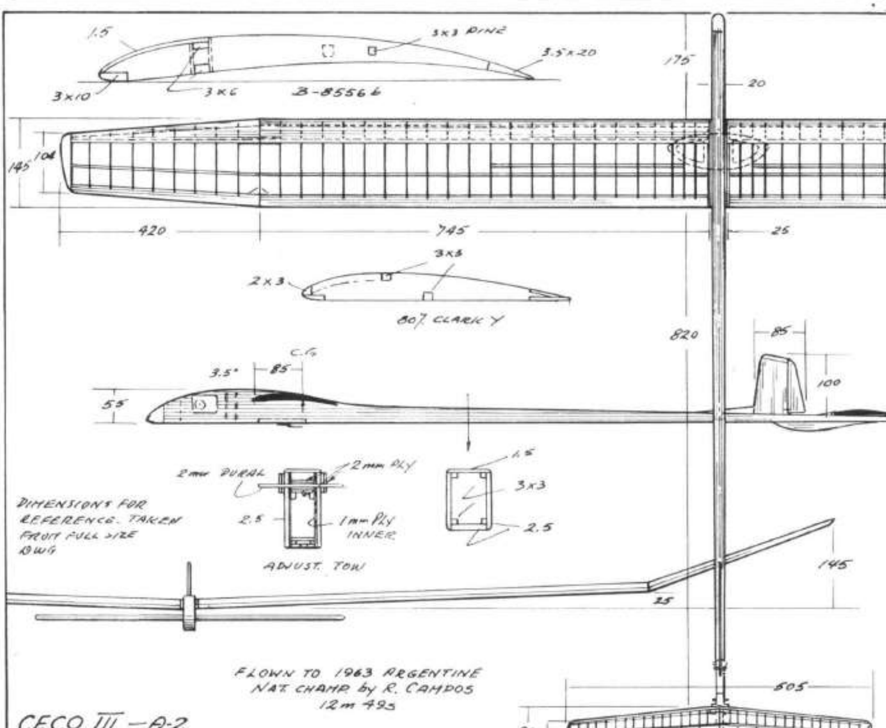




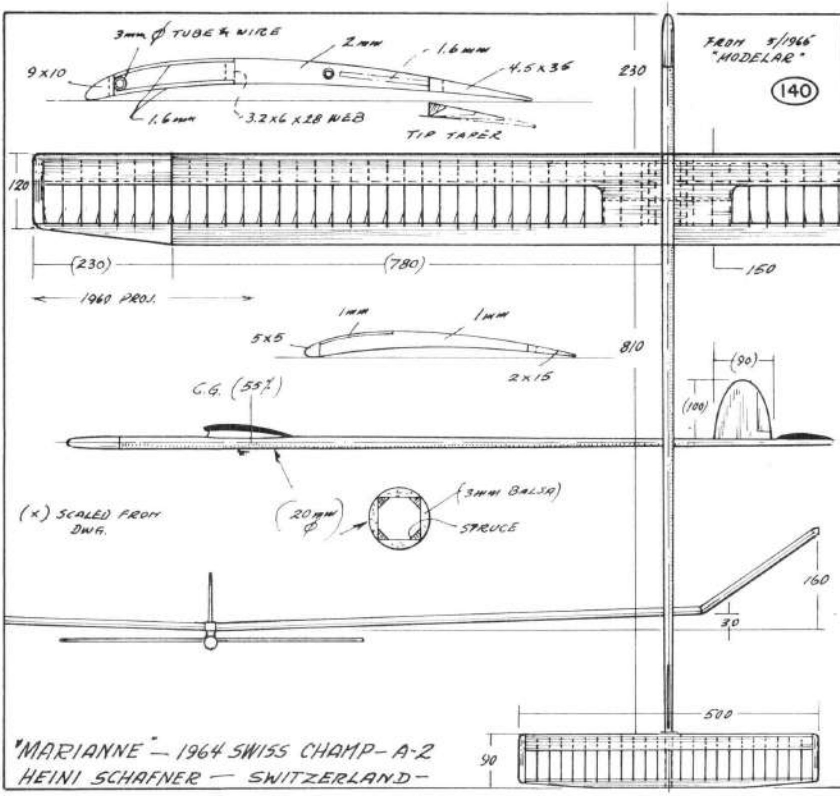
138
REODOR II - NORMAN STÓVLAND - NORWAY
2 X 12
6 X 14
1 mm
BALSA
SPRUCE
4 - 2mm PLY RIBS WITH 2mm BALSA BET. EACH RIB
175
SILK COVER WING
150
330
1425
CARVED FROM SPRUCE
.7m PLY
2 X 2 SPR
USE SPR. ON CENTER PANELS
" BALSA " TIP "
3 X 35
2 X 4 SPR
3 X 3 SPR
21°
2°
2mm ALLOY DRILLED WITH HOLES
PLY
2mm
5mm SOFT BALSA SIDES
42
777
2.5mm HWD IN TWO HALVES
A
63% C.G.
1.5°
BOOM 21ϕ → 12ϕ 2mm BALSA
76
76
2mm
-1°
A
B
3mm HWD
2mm BALSA
B
120
ADJUST. WT. USED IN 1956 ON REODOR I
21ϕ
BRASS
CYCOLAC PLASTIC
500
98
F. Zaic



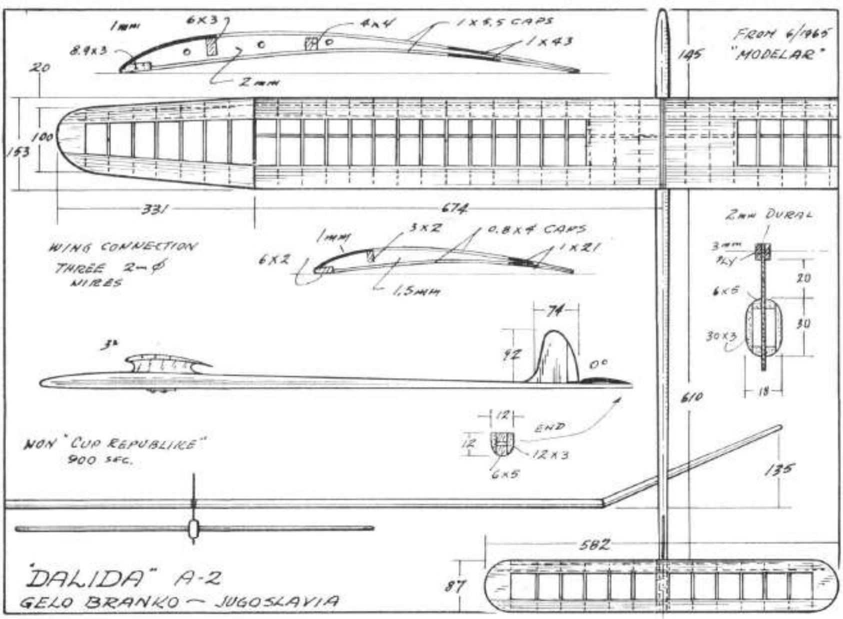
P-DGAC 62-1 A-2 – J.A.M. RAIMUNDO – PORTUGAL



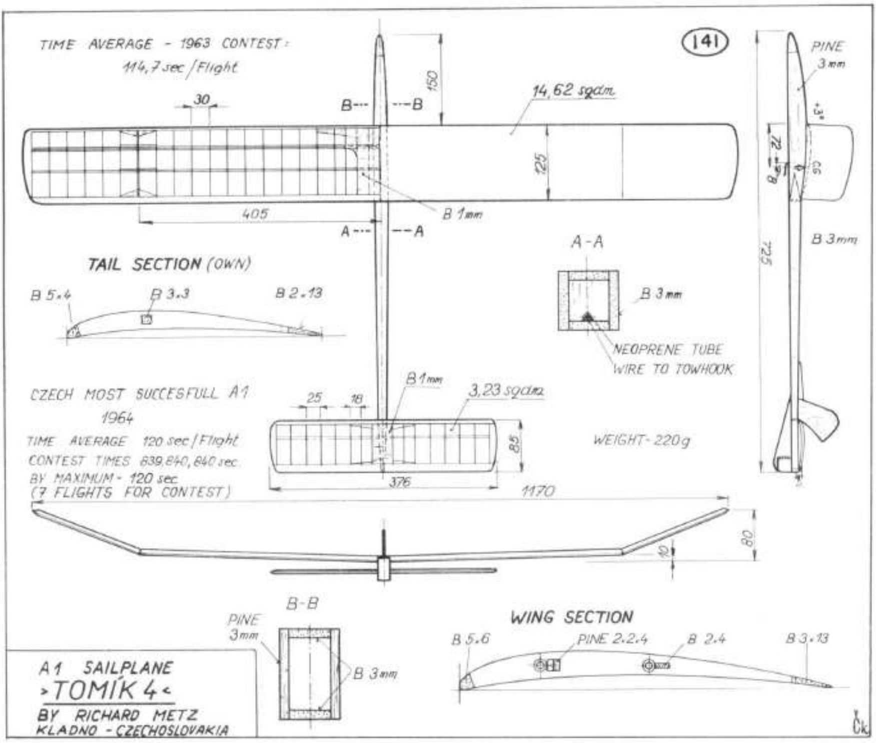
CECO III – A-2
R.E. CAMPOS & V. COFFEY – ARGENTINE

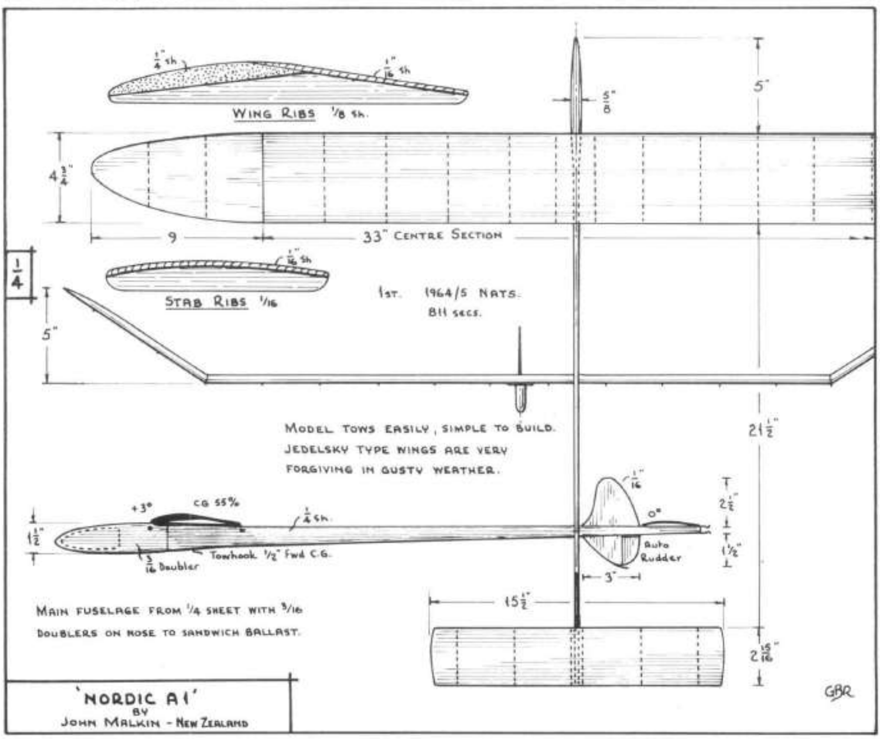


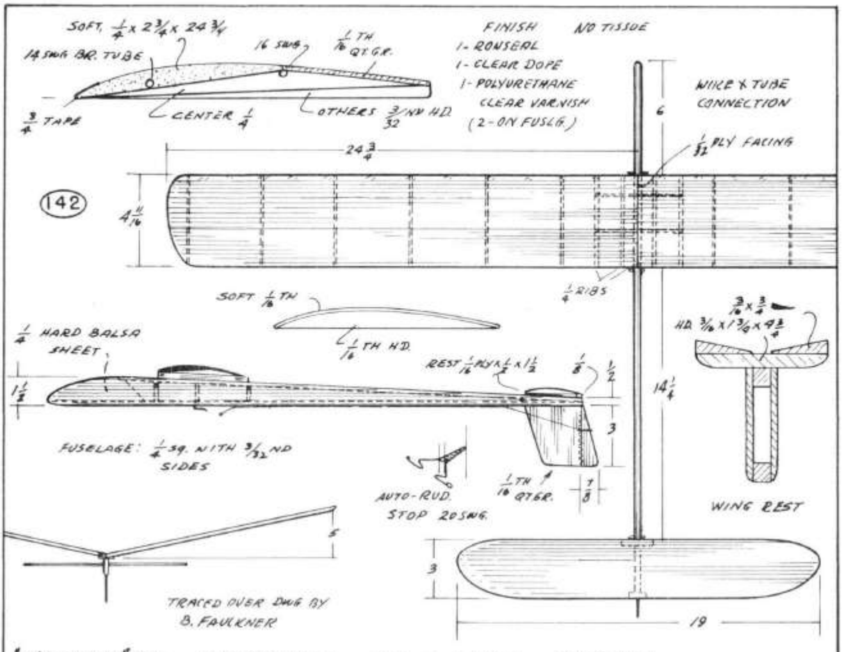
"MARIANNE" — 1964 SWISS CHAMP — A-2
HEINI SCHAFNER — SWITZERLAND —



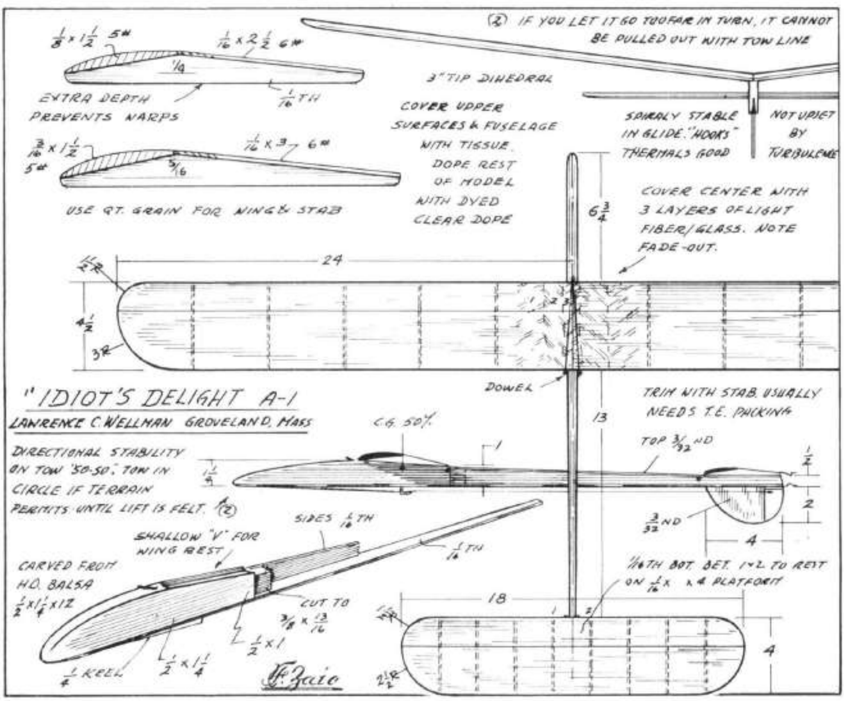
"DALIDA" A-2
GELO BRANKO — JUGOSLAVIA

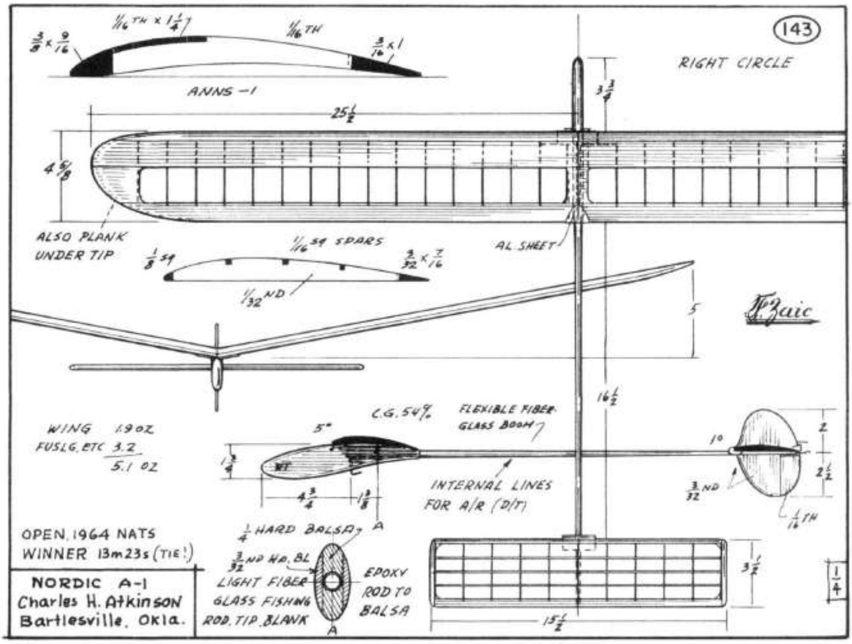

141
TIME AVERAGE - 1963 CONTEST:
114,7 sec / Flight
30
150
B--- ---B
14,62 sqdm
125
405
B 1mm
A--- ---A
PINE
3mm
+3°
72
8
CG
725
B 3mm
TAIL SECTION (OWN)
B 5×4
B 3×3
B 2×13
A-A
B 3mm
NEOPRENE TUBE
WIRE TO TOWHOOK
CZECH MOST SUCCESFULL A1
1964
TIME AVERAGE 120 sec / Flight
CONTEST TIMES 839, 840, 840 sec
BY MAXIMUM - 120 sec
(7 FLIGHTS FOR CONTEST)
25
18
B 1mm
3,23 sqdm
85
376
WEIGHT - 220g
1170
80
10
B-B
PINE
3mm
B 3mm
WING SECTION
B 5×6
PINE 2.2.4
B 2.4
B 3×13
A1 SAILPLANE
›TOMÍK 4‹
BY RICHARD METZ
KLADNO - CZECHOSLOVAKIA
Čk

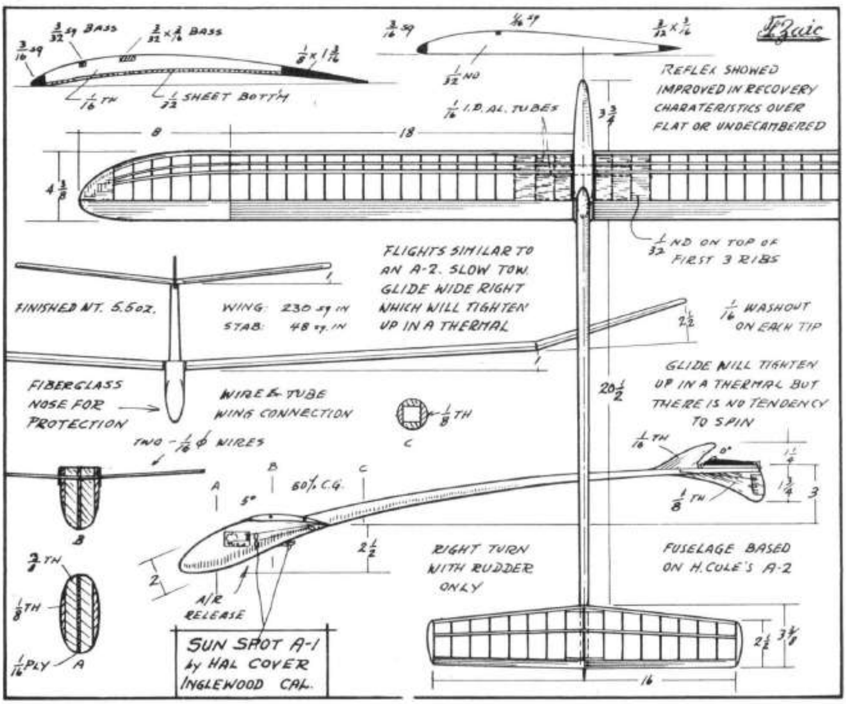

1/4" sh.
1/16" sh
WING RIBS 1/8 sh.
5"
5/8"
4 3/4"
9
33" CENTRE SECTION
1/4
1/16" sh
STAB RIBS 1/16
1ST. 1964/5 NATS.
811 secs.
5"
MODEL TOWS EASILY, SIMPLE TO BUILD.
JEDELSKY TYPE WINGS ARE VERY
FORGIVING IN GUSTY WEATHER.
21 1/2"
+3°
CG 55%
1/4 sh.
1/16"
0°
2 1/2"
1 1/2"
1 1/2"
3/16 Doubler
Towhook 1/2" Fwd C.G.
Auto Rudder
3"
MAIN FUSELAGE FROM 1/4 SHEET WITH 3/16
DOUBLERS ON NOSE TO SANDWICH BALLAST.
15 1/2"
2 15/16"
'NORDIC A1'
BY
JOHN MALKIN - NEW ZEALAND
GBR

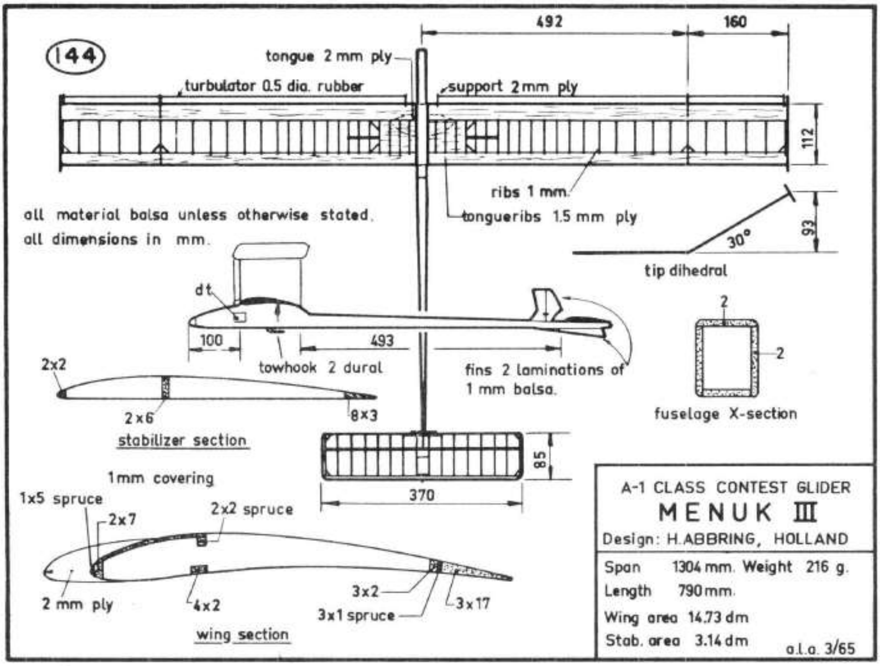


"KABAN" A-1 BILL HORTON CRAWLEY M.A.C. ENGLAND

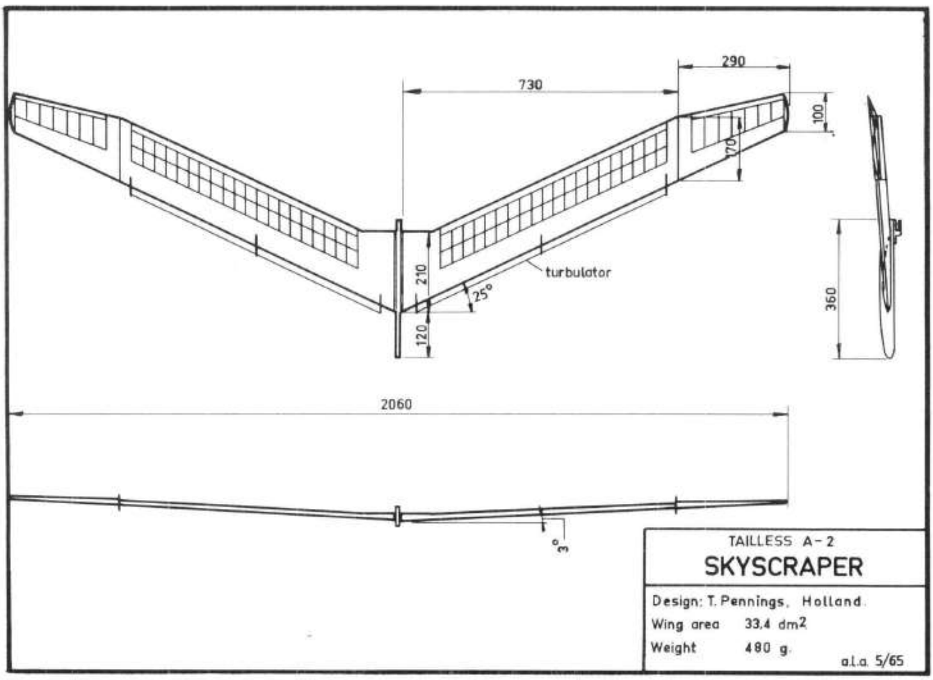



143
1/16 TH x 1 1/4
1/16 TH
3/8 x 9/16
3/16 x 1
ANNS - 1
RIGHT CIRCLE
25 1/2
3 3/4
4 5/8
ALSO PLANK UNDER TIP
1/16 SQ SPARS
1/8 SQ
3/32 x 7/16
1/32 ND
AL. SHEET
5
F. Zaic
16 1/2
C.G. 54%
FLEXIBLE FIBER GLASS BOOM
5°
WING 1.9 OZ
FUSLG. ETC 3.2
5.1 OZ
1 3/4
4 3/4
1 3/8
INTERNAL LINES FOR A/R (D/T)
1°
2
2 1/2
3/32 ND
1/16 TH
OPEN. 1964 NATS WINNER 13m23s (TIE!)
1/4 HARD BALSA
A
3/32 ND HD. BL
LIGHT FIBER GLASS FISHING ROD. TIP. BLANK
EPOXY ROD TO BALSA
3 1/2
15 1/2
1/4
NORDIC A-1
Charles H. Atkinson
Bartlesville, Okla.

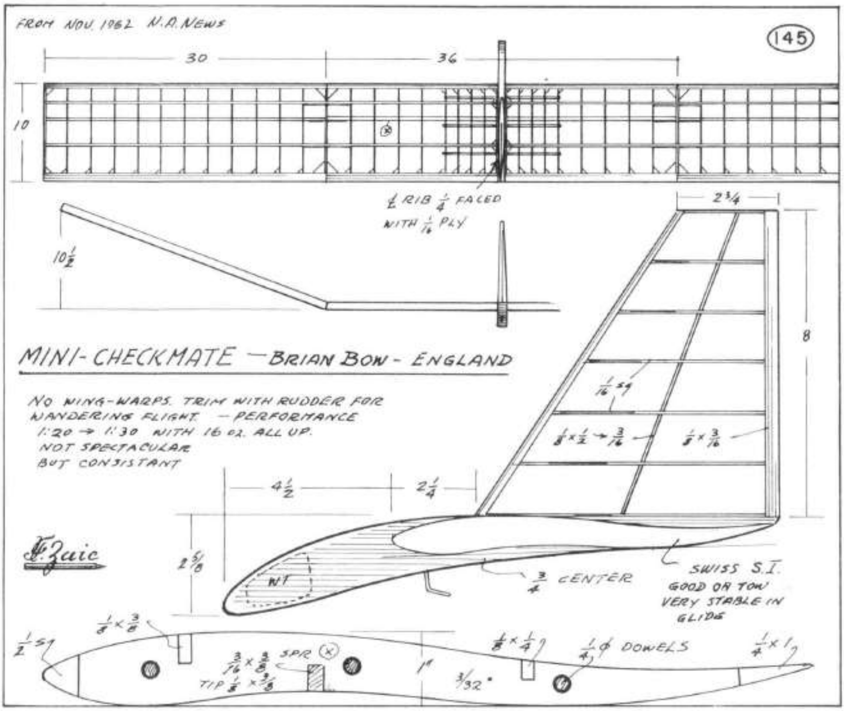

3/32 SQ BASS
3/32 x 3/16 BASS
3/16 SQ
1/8 x 1 3/8
1/16 TH
1/32 SHEET BOTT'M
3/16 SQ
1/16 SQ
3/32 x 3/16
1/32 ND
F. Zaic
1/16 I.D. AL. TUBES
3 3/4
REFLEX SHOWED IMPROVED IN RECOVERY CHARATERISTICS OVER FLAT OR UNDECAMBERED
8
18
4 3/8
1/32 ND ON TOP OF FIRST 3 RIBS
FLIGHTS SIMILAR TO AN A-2. SLOW TOW. GLIDE WIDE RIGHT WHICH WILL TIGHTEN UP IN A THERMAL
FINISHED WT. 5.5 OZ.
WING: 230 sq in
STAB: 48 sq. in
1
2 1/2
1/16 WASHOUT ON EACH TIP
GLIDE WILL TIGHTEN UP IN A THERMAL BUT THERE IS NO TENDENCY TO SPIN
20 1/2
FIBERGLASS NOSE FOR PROTECTION
WIRE & TUBE WING CONNECTION
1/8 TH
C
TWO - 1/16 ϕ WIRES
B
A
5°
60% C.G.
1/16 TH
0°
1 1/4
1 3/4
3
1/8 TH
3/8 TH
1/8 TH
1/16 PLY
2
2 1/2
A/R RELEASE
RIGHT TURN WITH RUDDER ONLY
FUSELAGE BASED ON H. COLE'S A-2
SUN SPOT A-1
by HAL COVER
INGLEWOOD CAL.
2 1/2
3 1/8
16

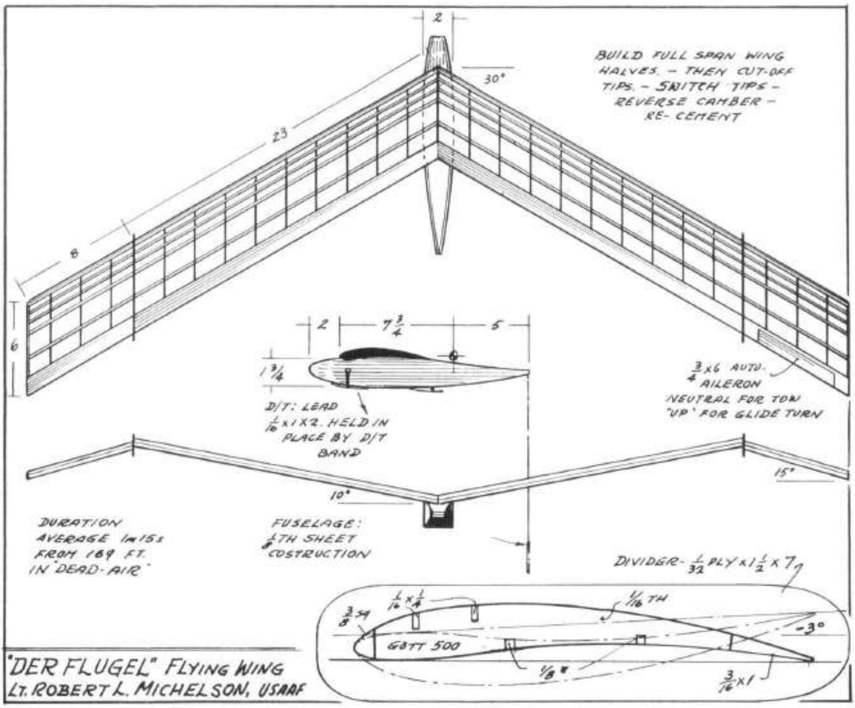


144
tongue 2 mm ply
turbulator 0.5 dia. rubber
support 2 mm ply
492
160
112
ribs 1 mm.
tongueribs 1.5 mm ply
all material balsa unless otherwise stated.
all dimensions in mm.
30°
93
tip dihedral
dt
100
493
towhook 2 dural
fins 2 laminations of 1 mm balsa.
2
2
fuselage X-section
2x2
2x6
8x3
stabilizer section
85
370
1mm covering
1x5 spruce
2x7
2x2 spruce
2 mm ply
4x2
3x2
3x1 spruce
3x17
wing section
A-1 CLASS CONTEST GLIDER
MENUK III
Design: H.ABBRING, HOLLAND
Span 1304 mm. Weight 216 g.
Length 790 mm.
Wing area 14.73 dm
Stab. area 3.14 dm
a.l.a. 3/65



290
730
100
170
210
25°
turbulator
120
360
2060
3°
TAILLESS A-2
SKYSCRAPER
Design: T. Pennings, Holland.
Wing area 33.4 dm2
Weight 480 g.
a.l.a. 5/65


FROM NOV. 1962 N.A. NEWS
30
36
10
1/4 RIB 1/4 FACED WITH 1/16 PLY
2 3/4
10 1/2
8
MINI-CHECKMATE — BRIAN BOW - ENGLAND
NO WING-WARPS. TRIM WITH RUDDER FOR WANDERING FLIGHT. — PERFORMANCE 1:20 → 1:30 WITH 16 OZ. ALL UP. NOT SPECTACULAR BUT CONSISTANT
1/16 SQ
1/8 x 1/2 → 3/16
1/8 x 3/16
4 1/2
2 1/4
2 5/8
WT
3/4 CENTER
SWISS S.I. GOOD OR TOW VERY STABLE IN GLIDE
F. Zaic
1/2 SQ
1/8 x 3/8
3/16 x 3/8 SPR
TIP 1/8 x 3/8
1"
3/32"
1/8 x 1/4
1/4 ⌀ DOWELS
1/4 x 1


2
30°
BUILD FULL SPAN WING HALVES. — THEN CUT-OFF TIPS. — SWITCH TIPS — REVERSE CAMBER — RE-CEMENT
23
8
6
2
7 3/4
5
1 3/4
D/T: LEAD 1/16 x 1 x 2. HELD IN PLACE BY D/T BAND
3/4 x 6 AUTO-AILERON NEUTRAL FOR TOW "UP" FOR GLIDE TURN
15°
10°
DURATION AVERAGE 1m 15s FROM 169 FT. IN "DEAD-AIR"
FUSELAGE: 1/8TH SHEET COSTRUCTION
DIVIDER - 1/32 PLY x 1 1/2 x 7
3/8 SQ
1/16 x 1/4
1/16 TH
-3°
GÖTT 500
1/8"
3/16 x 1
"DER FLUGEL" FLYING WING
LT. ROBERT L. MICHELSON, USAAF

MICROFILM HISTORY

J. P. Glass Clifton Heights, Pa.

Thank you for the article translated from the German. The writer seems to know his stuff pretty well. It is obvious that his presentation was made for the benefit of full size aeronautical engineers as shown by the use of complicated terms and formulas, but there is actually no new content not known long ago to the expert indoor builder.

He also glosses over one or two things that I would think would be significant. One is the use of quartered balsa wood for increased stiffness where the parts must be made quite thin, as in the hollow tube in the motor strut; the other is the very bad effect of sandpapering balsa wood, which massages all of the outer grain where your strength and stiffness is and for these reasons we mostly always tried to use square sticks which could be cut with a razor blade and not subject to the bruising effect of trying to round them up. There is one other effect he neglects; in making drop tests on microfilm-covered tail sections, I quickly discovered that the fore and aft spars covered with microfilm had less than half the drag they had before they were covered. Apparently the microfilm insured that the rear spar flew in the back draft of the front one and contributed very little drag itself. The drag of microfilm is radically less than that of paper.

As to your question about the tungsten wire, this started primarily due to Wilbur Tyler, who kept begging for me for some wire. He tried to use copper which was about three mils, too heavy and too weak. I was trying to get him to use bamboo thread but he was too lazy to make them. So I went down to MIT and beat a professor out of a spool of .0015 tungsten, which seemed to do the trick very nicely. Incidentally, I've still got most of that spool.

On microfilm, Bob Clary was clearly the first to make large sheets of nitro-cellulose by spreading the material on water. In the summer of 1929 I had made a very careful study of the weight factors on an indoor model at a time when the record was on the order of six or seven minutes and had come to the conclusion that the indoor model ought to fly about an hour except that something was wrong. One of the principal things wrong turned out to be the very poor lift-over-drag of the paper covering for the wings and also excessive weight of even the lightest paper. In discussing this with Bob, he had the idea of soap films, then oil films, then he tried pouring dope into my basin and I had to eject him from my room before he plugged it up. Within a few months, though, he had sheets as much as three feet long and two feet wide of material which would today be called "cellophane" but which at that time was really radical.

His method consisted of continuing to add every imaginable kind of thing to a quart or two of dope he had in a gallon can. Shakespeare's witches in Macbeth or Al Capp's boys making Kickapoo Joy Juice would have been proud of the mixture because it contained everything from Ambroid, dope, toothbrushes and lacquer but it worked out very well and made a reasonably tough microfilm.

In attempting to use this material we tried to use it like paper and if you ever want a frustrating experience try taking microfilm off the frame before putting it on the wing frame. But we smartened up on that fairly quickly.

I believe that Bob introduced this down in New York probably some time during 1930. A year or two later the boys in Boston very much wanted to make some and I had to repeat some of Bob's experiments and by using known materials was able to demonstrate that an unplasticized solution of nitro-cellulose in a single solvent would not work but that the addition of the proper proportion, quite critical, of a higher boiling solvent would plasticize temporarily the spreading front of the film and cause the film to expand practically to the limit of the water surface on which the dope drop was placed. Once these paired proportions were established, the mixtures could be mixed in any proportions. This film proved quite unsatisfactory in that it was weak and easily split. Following the known techniques of lacquer paint manufacturers the introduction of castor oil and dibutyl thalate plasticized the film and made it as tough (or gummy) as you pleased. Apparently the effect of the castor oil is to introduce microscopic discontinuities in the film which act as tear-stoppers, whereas the introduction of dibutyl thalate (tri-cresol phosphate) acts as a plasticizing solvent which prevents the film from getting extremely hard. The best plasticizers seem to be approximately a fifty-fifty mixture of castor oil and dibutyl thalate when added together in sufficient quantity to give the desired flexibility.

The best gun cotton for this use has a viscosity coefficient of 75 centistokes and up. The lower viscosity normally used for lacquers makes a weak film. The cotton should be placed in a cloth bag and the alcohol normally used to keep the cotton safe from explosion allowed to dry out over a period of several days. In order to get the cotton to dissolve it sure helped to first wet the dry cotton with just enough benzol to get all through it.

The addition of small amounts of lacquer apparently introduced other gum and resins and also solvents that were more water repellent than the ethyl, butyl and amyl acetates that I was using and tended to prevent water absorption into the film, giving a better initial toughness. By about 1933 practically nothing else except microfilm was being used in Boston. (Bruno Marchi could never make microfilm and took a long time to find out it was because his sister used a fairly potent bath salt that kept any water drawn in that tub from having the proper capillary action. So he had to get all of his microfilm from Tyler, who was quite expert.)

INDOOR — 1965 STYLE

Bud Tenny Richardson, Texas

The fascinating field of indoor modeling has acquired new dimensions in the four years since the AMA established ceiling categories. Before the change, indoor activity was slowly dwindling. A few serious indoor fliers congregated around sites in California, Detroit, Chicago, Cleveland and the East Coast hangars at South Weymouth and Lakehurst. Fliers had little hope of establishing new indoor records unless they could get to a hangar during the infrequent times one was open.

When the ceiling categories came in, the nature of the activity slowly changed as indoor activity accelerated. The new Category I ceilings (up to 35′) qualified almost every gym, recreation hall and small auditorium as a potential competition site. The Category II limits of 35′ to 100′ gave official recognition to the efforts in Detroit, Chicago and Cleveland; fairly regular winter activity started in low Cat. II sites in Denver, Dallas, Kokomo and the M. I. T. Armory, to name a few now-active locales.

The increase in serious activity soon saw many respectable records established in the stick classes, plus an upsurge in activity in the cabin classes and in the helicopter, ornithopter and autogyro classes.

After four years of evolution, the hobby/sport world of indoor is populated by several different groups of fliers. The serious fliers, seeking ultimate performance for rubber models and gliders in each particular site, continue to make significant progress in the state of the art through advances in aerodynamics and techniques.

A small, active group of experimenters are making steady developments in the experimental classes — particularly in autogyro and ornithopter. Very little new has developed in helicopter, since low ceiling helicopter flights spend about eighty percent of the "duration" with the model trying to bore a hole in the ceiling!

In the past three years indoor scale flying has had a tremendous boom in popularity, particularly in California. Numerous people are researching aviation history to make plans of little-known airplanes available to indoor scale buffs. As a result, this group of fliers has a large number of airplane designs available, and an indoor scale judge has no risk of being bored for lack of variety.

Soon after ceiling categories were instituted, Wally Miller (a member of the Wilmington Indoor Model Airplane Club — the first all-indoor club) developed a "formula model" known as the Easy B. The formula was: 18″ maximum span, 3″ maximum chord, all balsa prop, solid motor stick and tail boom and no bracing. The

Easy B is a good beginner model, and can be an excellent "fun model" for the expert, depending upon the needs of the group. The Easy B is ideally suited to small Cat. I and Cat. II sites, and many indoor contests are made up of only Easy B, HLG and indoor scale events.

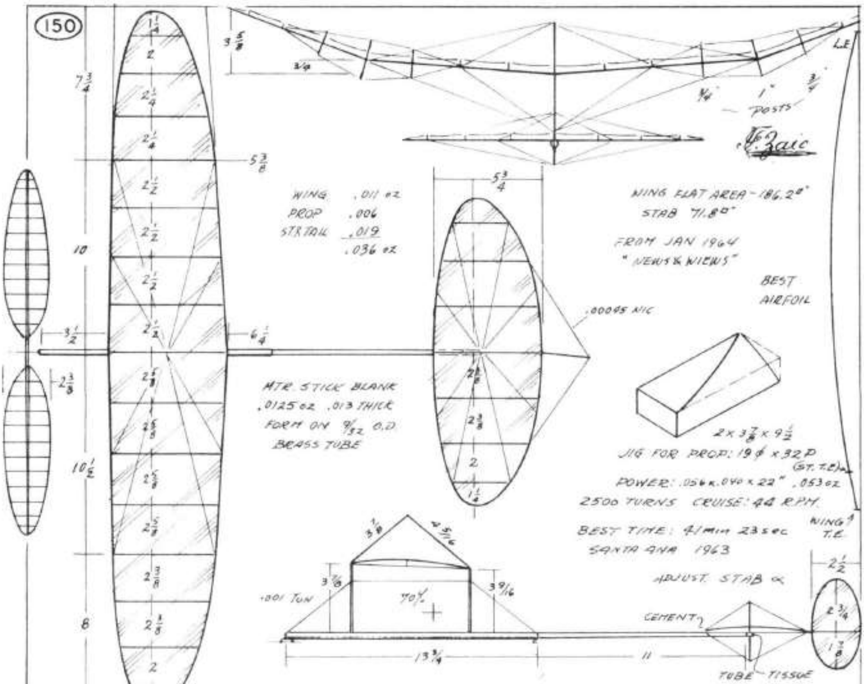
A new and exciting competition is springing up between far-flung clubs — indoor postal contests. Clubs or individuals contact each other and agree on events, then each group flies in their own site. The results are exchanged by mail and the winner declared — an interesting and challenging competition!

There are very few "indoor only" fliers — so indoor activity is dependent upon fliers from outdoor events. Consequently, much of the indoor flying takes place during the winter when it is too cold to fly the outdoor events. This seems strange to the dedicated indoor man: the conditions are almost always better in the summer, while indoor models are difficult and almost unpleasant to handle in the cold unheated buildings. Also, many of the good sites are idle in the summer, but are crowded with basketball players in the winter.

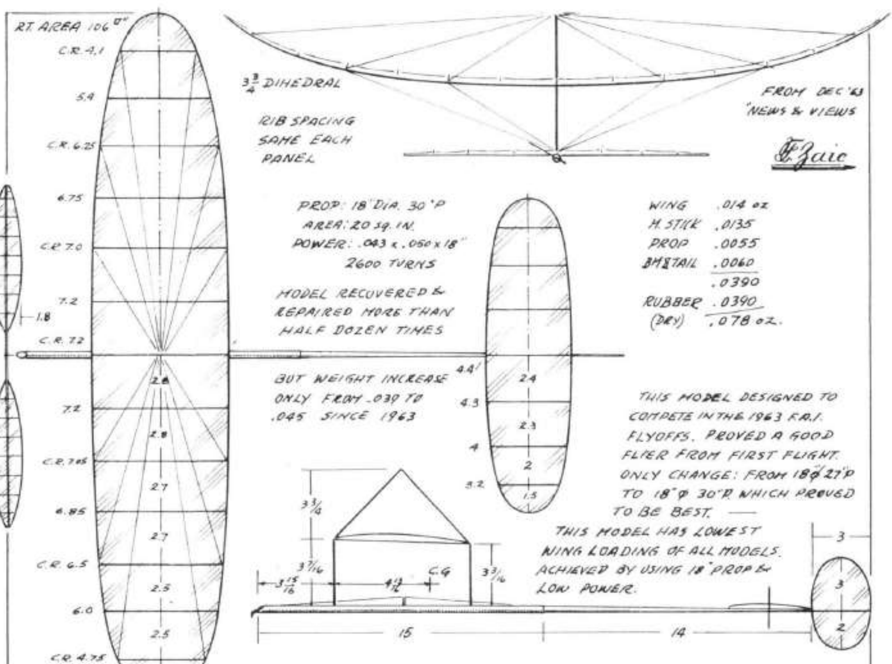
The new low ceiling flying poses a whole set of new problems in design and flying. Cat. I hand launch gliders become fragile floaters which must roll out within inches of the ceiling; the launch pattern must be exactly placed to avoid the walls and obstructions and still have a suitably large glide circle. Instead of trying to peak just below the ceiling 160′ up, rubber fliers must plan on spending much of the flight near the ceiling, subject to turbulence and hangup. A small group of fliers or spectators in a small Cat. I site can set up drift (convection currents resulting from body heat) that will rapidly push models across the room and into the wall. If more than a few serious modelers try to fly at once in a small site, there will be many collisions. Finally, HLG and indoor scale models cannot be flown while rubber models are flying — the events must share the flying time on a strict schedule. This is a real hardship on fliers and contest management alike.

Even with these problems, the future is bright for all forms of indoor. Cat. I indoor stick records are around 14 and 15 minutes, and at least one Cat. I flight (unofficial) has been made over 18 minutes. In Cat. II, unofficial flights over 30 minutes have been made, while the Cat. III D Stick record is 43:42.

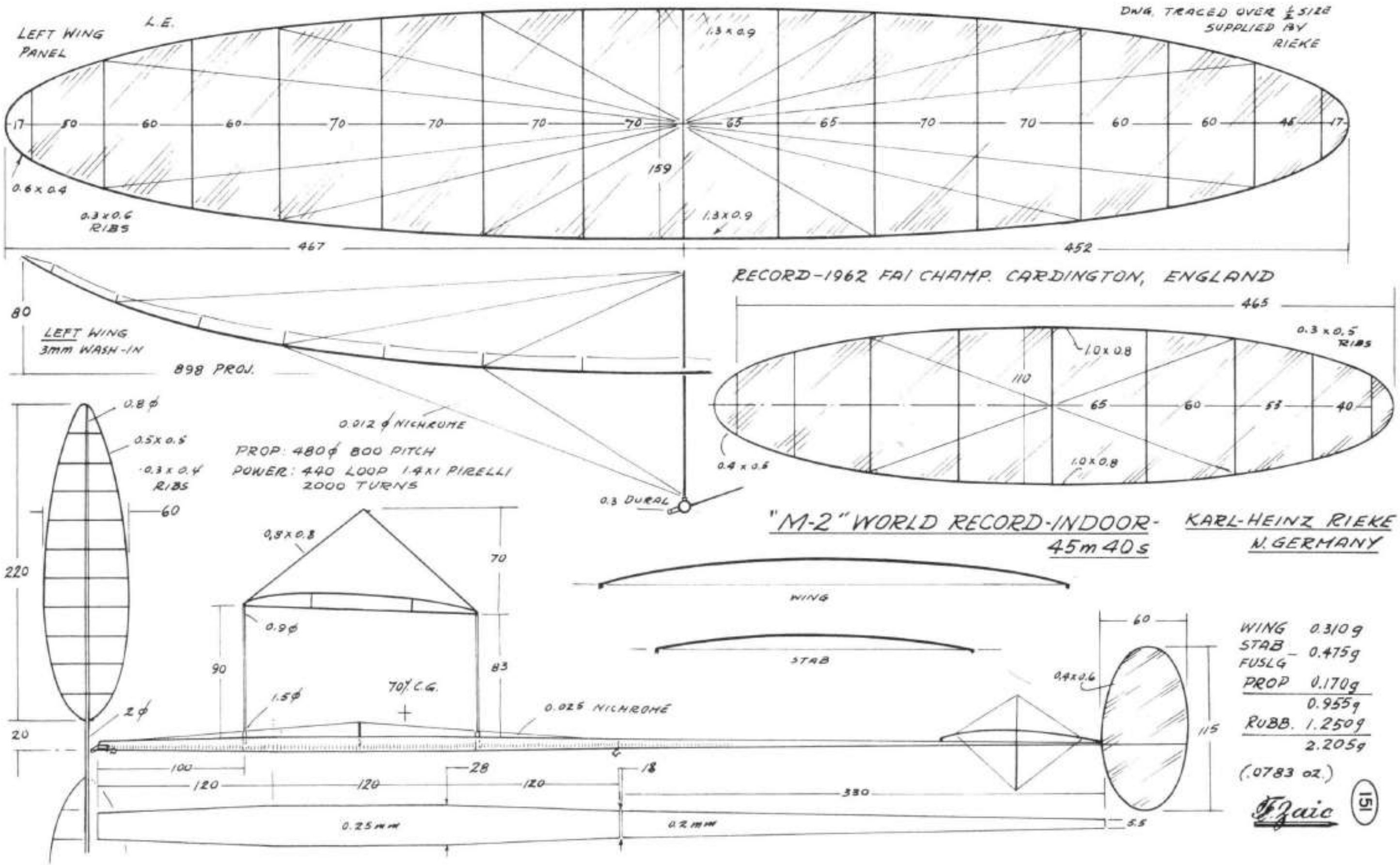
Most of the current indoor development is being done in FAI Indoor — the international class and the only World Record Class for indoor that is now recognized. Any Cat. III FAI Indoor contest with good flying conditions can be expected to produce some 40 minute flights, and two indoor fliers have done over 45 minutes in international competition. This is remarkable progress, since there were fewer than 20 members of the 30 Minute Club only five years ago!

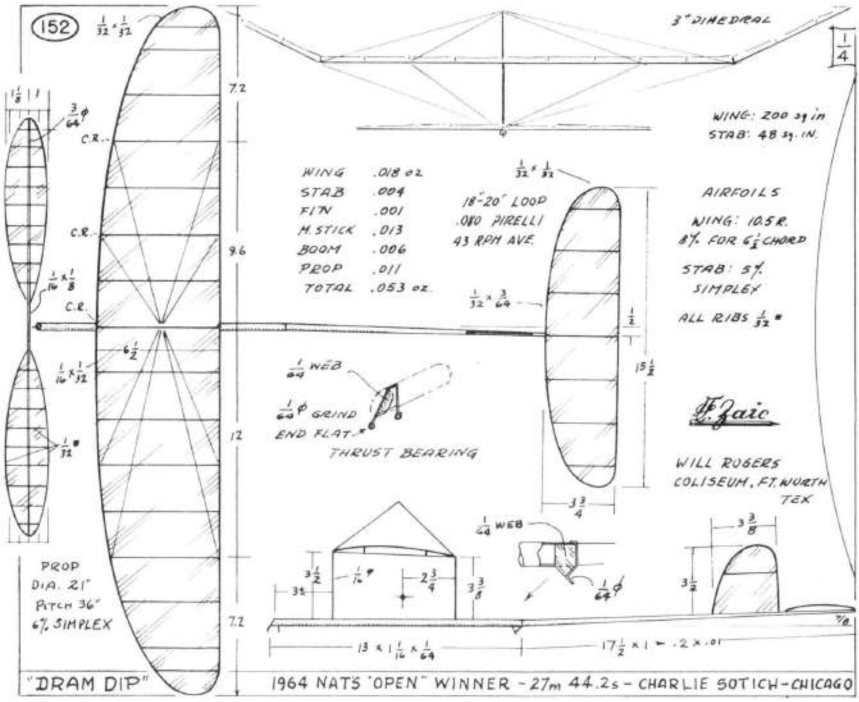


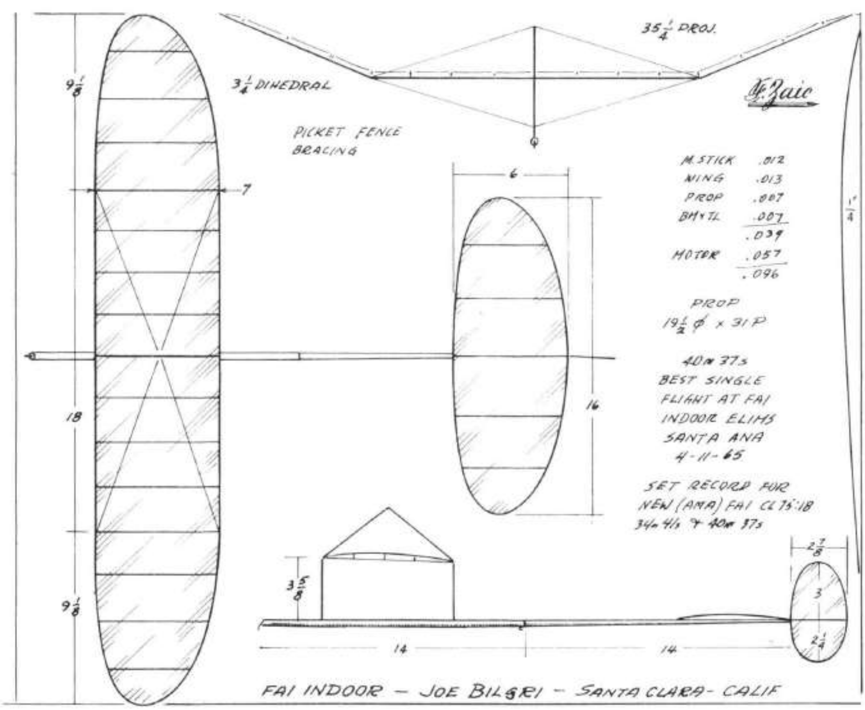
1963 INDOOR FAI — BOB CHAMPINE — YORKTOWN, VA.

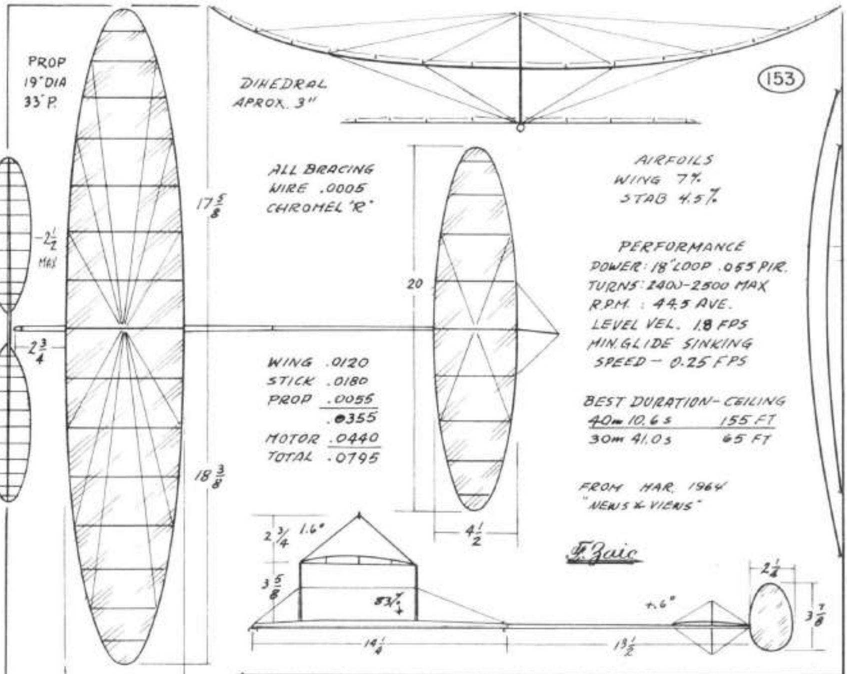


U.S.A. CLD, OPEN, RECORD - 43m 42s - ERNEST KOPECKY - WATCHUNG, N.J.

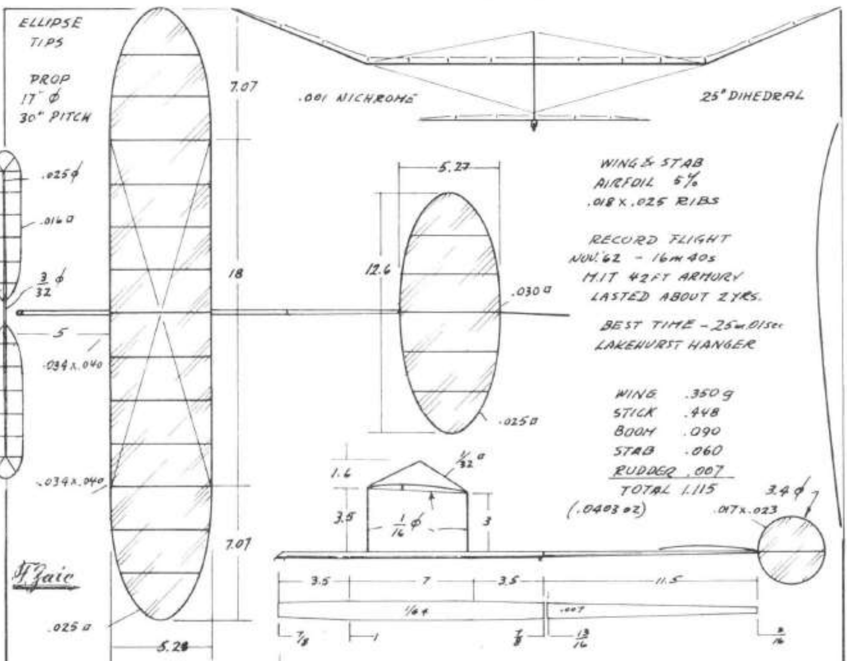

LEFT WING PANEL
L.E.
DWG. TRACED OVER ½ SIZE SUPPLIED BY RIEKE
1.3 x 0.9
17 50 60 60 70 70 70 70 65 65 70 70 60 60 45 17
159
0.6 x 0.4
0.3 x 0.6 RIBS
1.3 x 0.9
467
452
RECORD-1962 FAI CHAMP. CARDINGTON, ENGLAND
80
LEFT WING 3mm WASH-IN
898 PROJ.
465
0.3 x 0.5 RIBS
1.0 x 0.8
110
65 60 53 40
0.4 x 0.6
1.0 x 0.8
0.8 ϕ
0.5 x 0.5
0.3 x 0.4 RIBS
60
220
20
0.012 ϕ NICHROME
PROP: 480ϕ 800 PITCH
POWER: 440 LOOP 1.4x1 PIRELLI 2000 TURNS
0.3 DURAL
"M-2" WORLD RECORD-INDOOR- 45m 40s
KARL-HEINZ RIEKE N. GERMANY
0.8 x 0.8
70
WING
0.9ϕ
90
83
STAB
60
1.5ϕ
70% C.G.
2ϕ
0.025 NICHROME
0.4x0.6
115
100
120 120 120
28
18
330
0.25 mm
0.2 mm
5.5
WING 0.310g
STAB FUSLG 0.475g
PROP 0.170g
0.955g
RUBB. 1.250g
2.205g
(.0783 oz.)
F. Zaic
151


152
3° DIHEDRAL
1/4
WING: 200 sq in
STAB: 48 sq. IN.
WING .018 oz
STAB .004
FIN .001
M. STICK .013
BOOM .006
PROP .011
TOTAL .053 oz
18"-20" LOOP
.080 PIRELLI
43 RPM AVE.
AIRFOILS
WING: 10.5 R.
8% FOR 6 1/2 CHORD
STAB: 5%
SIMPLEX
ALL RIBS 1/32 ■
1/64 WEB
1/64 φ GRIND
END FLAT
THRUST BEARING
F. Zaic
WILL ROGERS
COLISEUM, FT. WORTH
TEX
PROP
DIA. 21"
PITCH 36"
6% SIMPLEX
7.2
9.6
12
7.2
6 1/2
15 1/2
3 3/4
3 3/8
3 1/2
2 3/4
13 x 1 1/16 x 1/64
17 1/2 x 1 - .2 x .01
"DRAM DIP"
1964 NATS "OPEN" WINNER - 27m 44.2s - CHARLIE SOTICH - CHICAGO

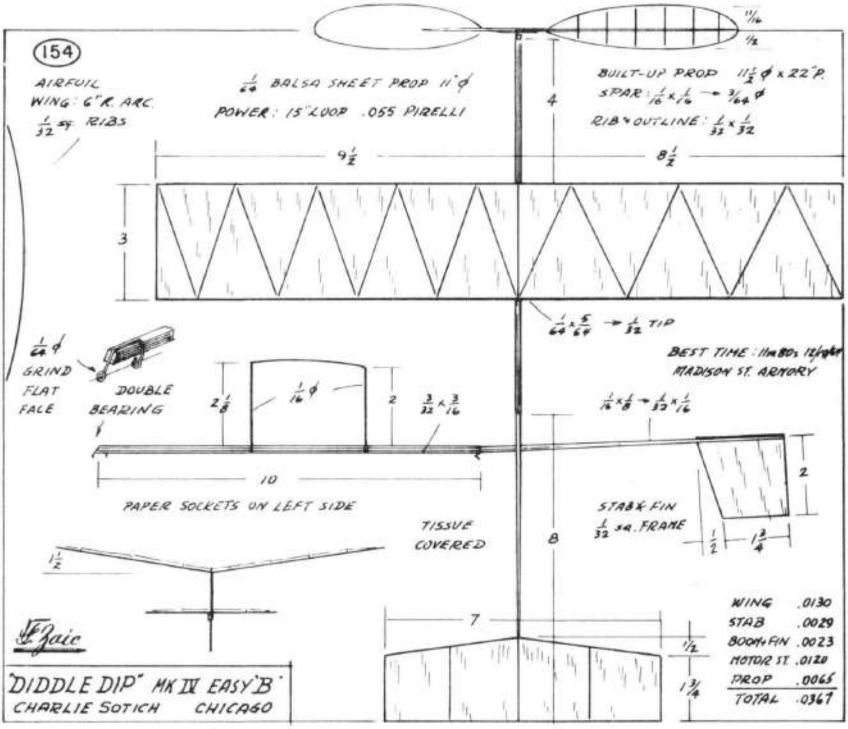

35 1/4 PROJ.
3 1/4 DIHEDRAL
F. Zaic
PICKET FENCE
BRACING
M. STICK .012
WING .013
PROP .007
BM + TL .007
.039
MOTOR .057
.096
PROP
19 1/2 φ x 31 P
40m 37s
BEST SINGLE
FLIGHT AT FAI
INDOOR ELIMS
SANTA ANA
4-11-65
SET RECORD FOR
NEW (AMA) FAI CL 75:18
34m 41s + 40m 37s
9 1/8
18
9 1/8
7
6
16
3 5/8
2 7/8
3
2 1/4
14
14
FAI INDOOR - JOE BILGRI - SANTA CLARA - CALIF

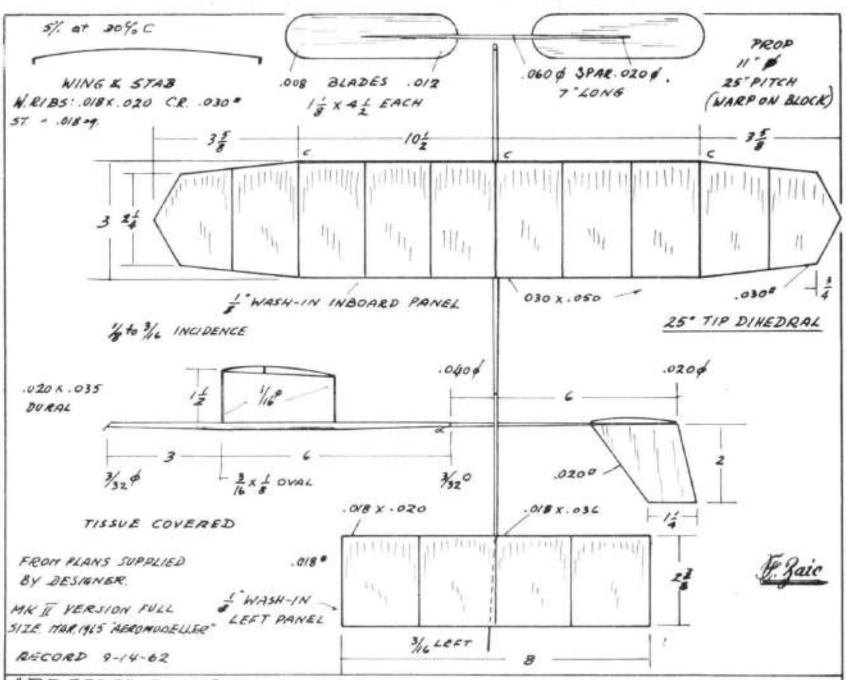


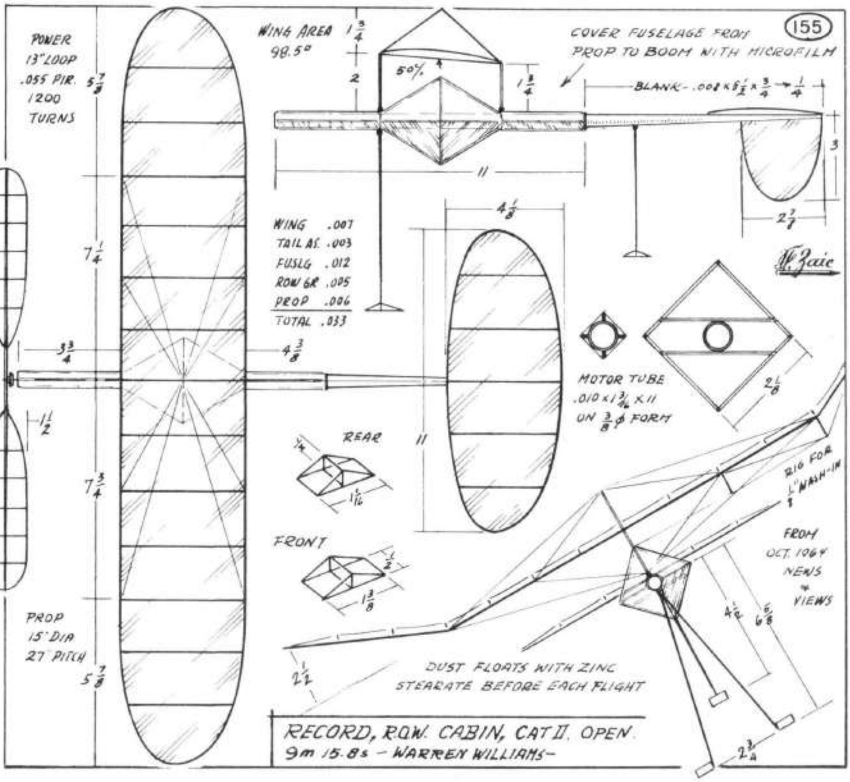
1963 NATS "OPEN" WINNER – DICK KOWALSKI – DETROIT

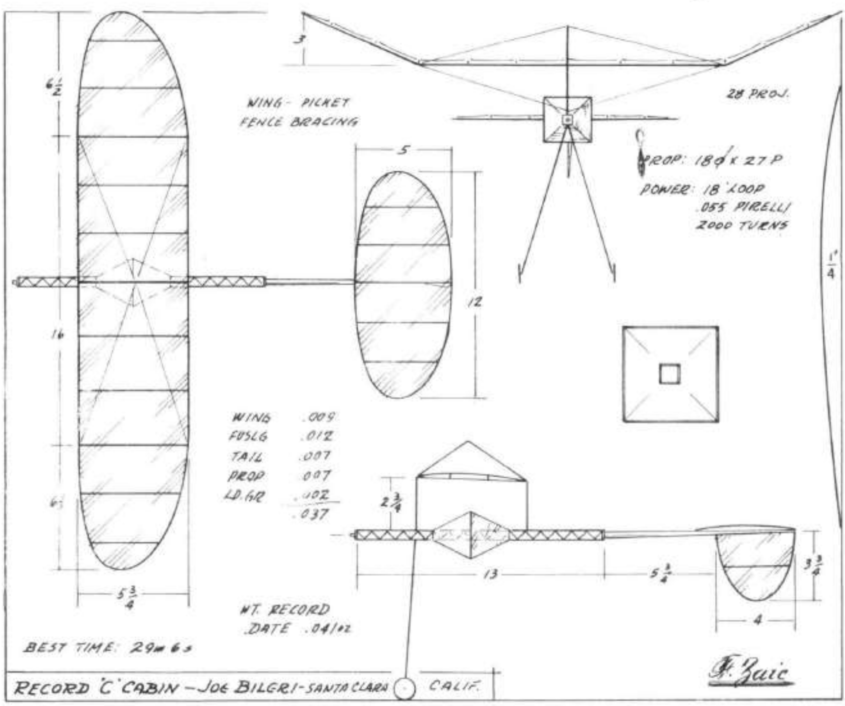


"CRUSHER C" X' RECORD CAT II SR. – ERIC GREENWALL – RICHLAND, WASH.


154
AIRFOIL
WING: 6" R. ARC
1/32 sq. RIBS
1/64 BALSA SHEET PROP 11"ø
POWER: 15" LOOP .055 PIRELLI
BUILT-UP PROP 11 1/2 ø x 22" P.
SPAR: 1/16 x 1/16 → 3/64 ø
RIB & OUTLINE: 1/32 x 1/32
11/16
1/2
4
9 1/2
8 1/2
3
1/64 x 5/64 → 1/32 TIP
1/64 ø
GRIND
FLAT
FACE
DOUBLE
BEARING
2 1/8
1/16 ø
2
3/32 x 3/16
BEST TIME: 11m 80s
MADISON ST. ARMORY
1/16 x 1/8 → 1/32 x 1/16
10
PAPER SOCKETS ON LEFT SIDE
STAB & FIN
1/32 sq. FRAME
2
1/2
1 3/4
TISSUE
COVERED
8
1 1/2
7
1/2
1 3/4
WING .0130
STAB .0029
BOOM + FIN .0023
MOTOR ST. .0120
PROP .0065
TOTAL .0367
F. Zaic
"DIDDLE DIP" MK IV EASY "B"
CHARLIE SOTICH CHICAGO


5% at 30% C
WING & STAB
W. RIBS: .018 x .020 C.R. .030"
ST. " .018 sq.
.008 BLADES .012
1 1/8 x 4 1/2 EACH
.060 ø SPAR .020 ø.
7" LONG
PROP
11" ø
25" PITCH
(WARP ON BLOCK)
3 5/8
10 1/2
3 5/8
C
C
C
3
2 1/4
1/8" WASH-IN INBOARD PANEL
030 x .050
.030"
3/4
25° TIP DIHEDRAL
1/8 to 3/16 INCIDENCE
.020 x .035
DURAL
1 1/2
1/16"
.040 ø
.020 ø
6
3
6
2
3/32 ø
3/16 x 1/8 OVAL
3/32"
.020"
1 1/4
TISSUE COVERED
.018 x .020
.018 x .036
FROM PLANS SUPPLIED
BY DESIGNER.
.018"
2 3/8
F. Zaic
MK II VERSION FULL
SIZE MAR. 1965 "AEROMODELLER"
1/8" WASH-IN
LEFT PANEL
3/16 LEFT
8
RECORD 9-14-62
"BREEZE" EASY-B CAT. I. SR. RECORD 10m 38.6s - LARRY H. RENGER - CALIF


155
POWER
13" LOOP
.055 PIR.
1200
TURNS
WING AREA
98.5□
50%
COVER FUSELAGE FROM
PROP TO BOOM WITH MICROFILM
BLANK - .002 x 6½ x ¾ → ¼
WING .007
TAIL AS. .003
FUSLG .012
ROW GR .005
PROP .006
TOTAL .033
MOTOR TUBE
.010 x 1 3/16 x 11
ON ⅜ ø FORM
REAR
FRONT
RIG FOR
⅛" WASH-IN
FROM
OCT. 1964
NEWS
&
VIEWS
PROP
15" DIA
27" PITCH
DUST FLOATS WITH ZINC
STEARATE BEFORE EACH FLIGHT
RECORD, R.O.W. CABIN, CAT II, OPEN.
9m 15.8s – WARREN WILLIAMS –
F. Zaic


WING - PICKET
FENCE BRACING
28 PROJ.
PROP: 18ø x 27 P
POWER: 18" LOOP
.055 PIRELLI
2000 TURNS
WING .009
FUSLG .012
TAIL .007
PROP .007
LD. GR .002
.037
WT. RECORD
DATE .04 / oz
BEST TIME: 29m 6s
RECORD "C" CABIN – JOE BILGRI - SANTA CLARA CALIF.
F. Zaic

WEIGHTS OF INDOOR MODELS

Curtis Janke — Sheboygan, Wis.

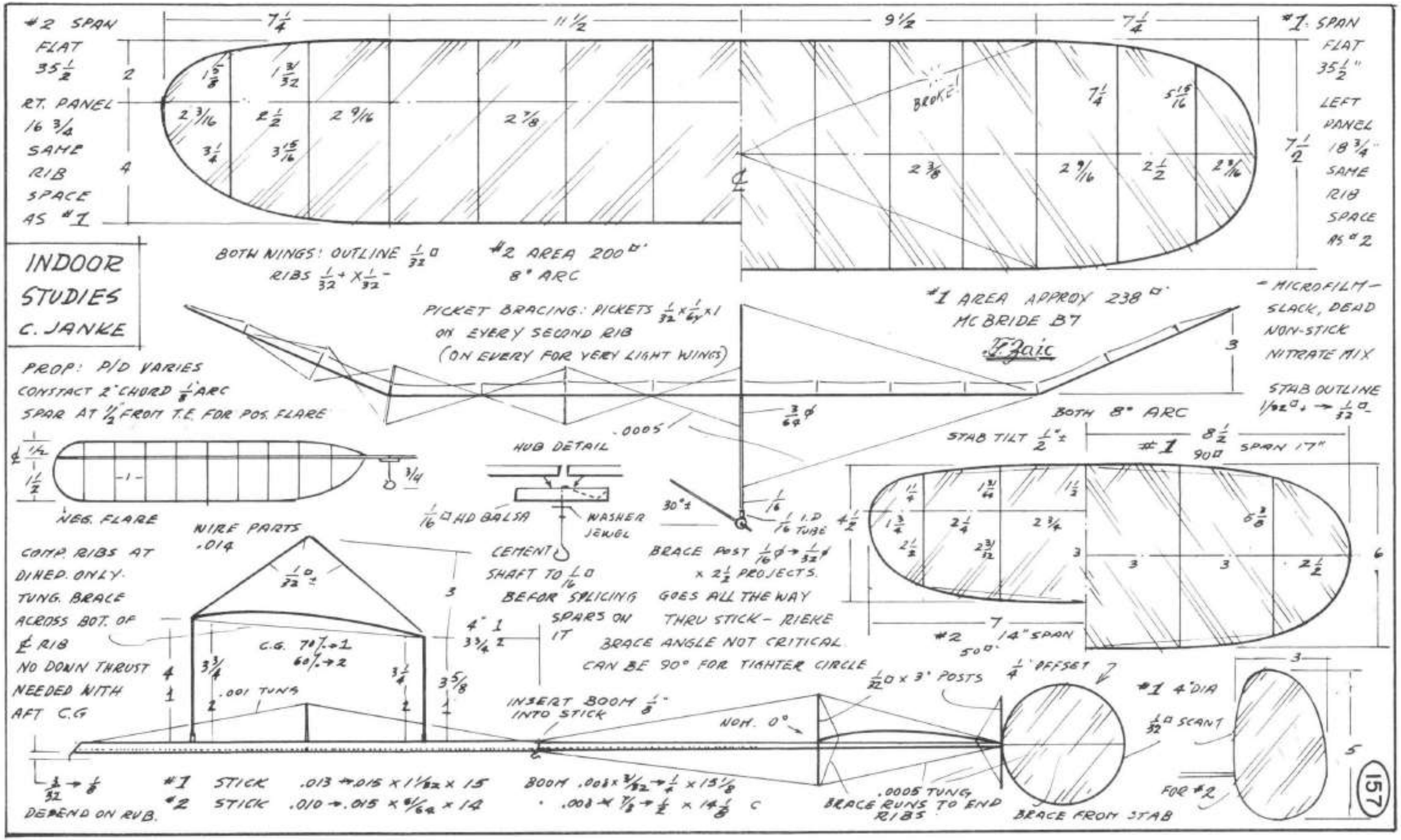
For light construction I use picket bracing on wings, brace L.E. & T.E. on my stabs (not cross braced) and do get very light ships when I try. (Perhaps my small spar sizes are what got the word to you via Dick Ganslen.) Bracing on the props cuts the weight quite a bit as well — and my props are quite weak and flexible even with bracing. I have sometimes used built-up ribs, that is, ribs resembling compression ribs, (the curve is bent from straight strips), but very much lighter, and saved some weight, but while they are more rigid and lighter than sliced-to-shape ribs they tend to be brittle.

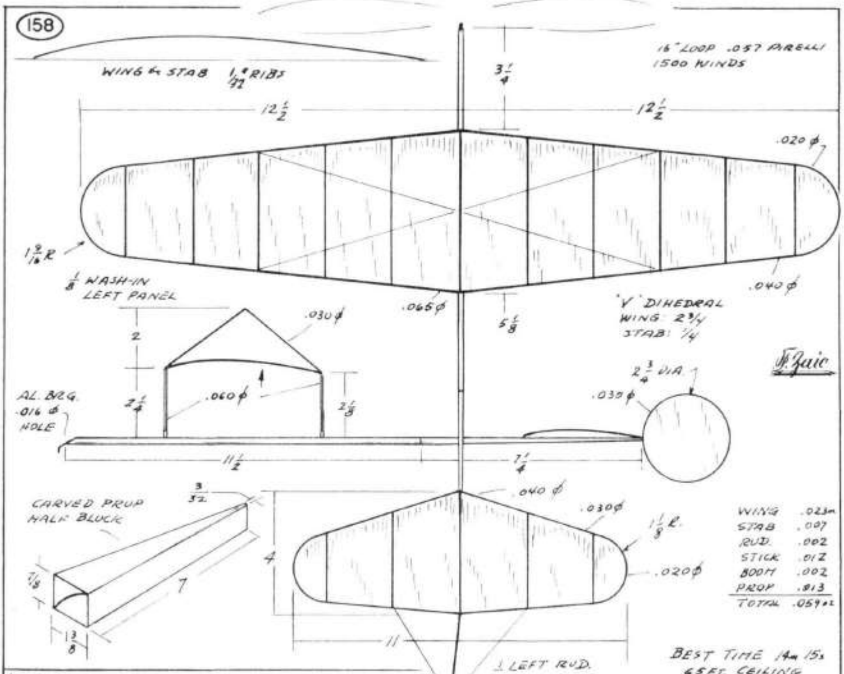
The best rib construction I have used is bent-to-shape single strip construction ribs, with a dacron tension brace across the bottom of each one to keep the arc curve from collapsing, but this is a great deal of extra work. Since such ribs are pre-bent much like tips and courved outlines, it is difficult to achieve the exact camber depth and hold it during construction and covering process, especially when the water may creep up onto the ribs and soak out the bend.

Shown are two ships, No. 1 and No. 2. Neither represents a particular type, but is configuration arrived at for a series of ships with weights and prop-power combinations occasionally varied. My best time so far (in Madison Street Armory in Chicago) is about 26 min. with No. 1 (with a 20" dia. back-flare, high pitch prop). And over 25 min. with No. 2 (using 18" dia. positive-flare and low P/D prop). The weights shown are a spread between light and heavy specimens, rather than exact figures on any one ship. I have built many of each size and vary weights and strength for different power ratios. I use an 18 in. loop of .060-.080 Pirrelli on No. 2 and .070-.080 on No. 1.

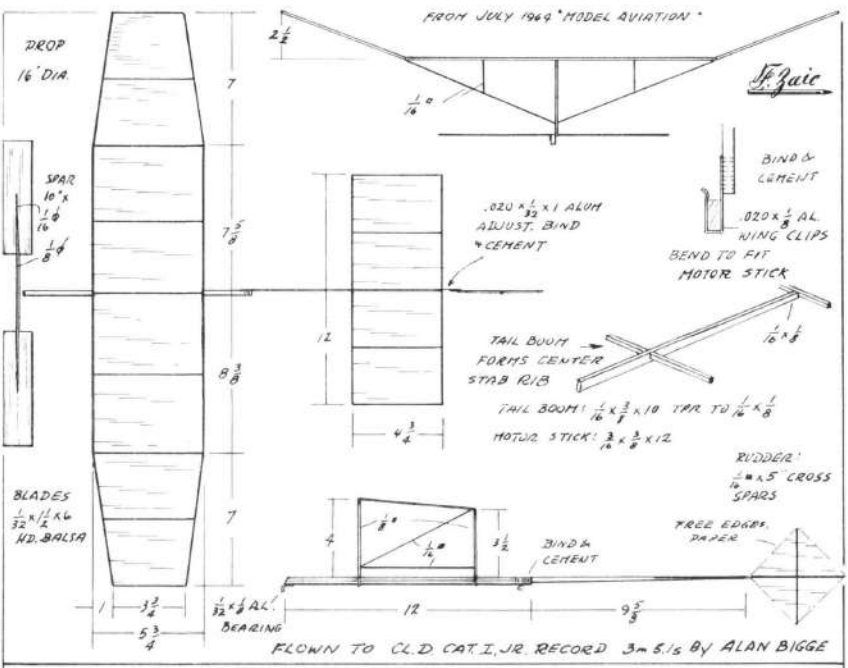
Spars	.0025	.0040
Tips	.00185	.0025
Ribs	.0028	.0035
Cabane	.0005	.0010
Struts	.001	.0015
Film	.0025	.004
Pick&Fence	.001	.001
WING	.01215	.0175
Blank	.0095	.011
Extras	.004	.004
STICK	.0135	.015
Outline	.001	.002
Ribs	.0007	.001
Film Max.	.00075	.001
STAB	.00245	.004
BOOM	.003	.004
RUDDER	.001	.001
PROP 20"	.0055	.007
NO.1 TOTAL	.0371 oz.	.0485 oz.

Spars	.0015	.0025
Tips	.0015	.002
Ribs	.0027	.0035
Cabane	.0005	.00175
Struts	.00052	.00075
Film	.002	.0025
Pick&Fence	.001	.001
WING	.00972	.014
Blank	.008	.010
Extras	.004	.004
STICK	.012	.014
Outline	.0012	.0015
Ribs	.0005	.0007
Film	.0005	.0005
STAB	.0022	.0025
BOOM	.0028	.003
RUDDER	.0005	.001
PROP 18"	.0045	.005
NO.2 TOTAL	.03172 oz.	.0395 oz.


#2 SPAN
FLAT
35 1/2
RT. PANEL
16 3/4
SAME
RIB
SPACE
AS #1
7 1/4
11 1/2
9 1/2
7 1/4
#1 SPAN
FLAT
35 1/2"
LEFT
PANEL
18 3/4"
SAME
RIB
SPACE
AS #2
BROKE!
INDOOR
STUDIES
C. JANKE
BOTH WINGS: OUTLINE 1/32 □
RIBS 1/32 + x 1/32 -
#2 AREA 200 □"
8" ARC
#1 AREA APPROX 238 □"
MC BRIDE B7
T. Zaic
- MICROFILM -
SLACK, DEAD
NON-STICK
NITRATE MIX
PICKET BRACING: PICKETS 1/32 x 1/64 x 1
ON EVERY SECOND RIB
(ON EVERY FOR VERY LIGHT WINGS)
PROP: P/D VARIES
CONSTANT 2" CHORD 1/8" ARC
SPAR AT 1/2" FROM T.E. FOR POS. FLARE
STAB OUTLINE
1/32 □ + → 1/32 □ -
BOTH 8" ARC
.0005
3/64 ø
HUB DETAIL
STAB TILT 1/2" ±
#1 8 1/2
90 □"
SPAN 17"
NEG. FLARE
1/16 □ HD BALSA
WASHER
JEWEL
30° ±
1/16
1/16 I.D. TUBE
WIRE PARTS
.014
CEMENT
SHAFT TO 1/16 □
BEFOR SPLICING
SPARS ON
IT
BRACE POST 1/16 ø → 1/32 ø
x 2 1/2 PROJECTS.
GOES ALL THE WAY
THRU STICK - RIEKE
BRACE ANGLE NOT CRITICAL
CAN BE 90° FOR TIGHTER CIRCLE
COMP. RIBS AT
DIHED. ONLY.
TUNG. BRACE
ACROSS BOT. OF
℄ RIB
NO DOWN THRUST
NEEDED WITH
AFT C.G
C.G. 70% → 1
60% → 2
.001 TUNG
#2
50 □"
14" SPAN
1/4" OFFSET
1/32 □ x 3" POSTS
#1 4" DIA
1/32 □ SCANT
INSERT BOOM 1/8"
INTO STICK
NOM. 0°
3/32 → 1/8
DEPEND ON RUB.
#1 STICK .013 → .015 x 1 1/32 x 15
#2 STICK .010 → .015 x 6/64 x 14
BOOM .003 x 3/32 → 1/4 x 13 1/8
.003 x 7/8 → 1/2 x 14 1/8
.0005 TUNG
BRACE RUNS TO END
RIBS
BRACE FROM STAB
FOR #2
157



"RELIABLE" INDOOR TISSUE – BILL GOUGH



"MAXECUTOR JR." CL. D. STICK – BILL BIGGE – WASHINGTON, D.C.

INDOOR FLYING SCALE

Harold Warner
Reseda, Calif.

Indoor scale combines the natural appeal of scale events with the twin blessings of calm-air flying and low cost models. The event has enjoyed a renaissance in Southern California through the efforts of the Wilmington Indoor Club and North American Flightmasters. Events fall into two categories: Built-up (stick and tissue) and all-sheet. The rules are deliberately kept to a minimum. The Flightmasters Rules for IFS are:

1: 30" maximum wingspan.
2: Unlimited size prop
3: Must be tissue covered
4: Model to be of a heavier-than-air man-carrying plane
5: 100 points to be awarded on the basis of fidelity to scale and workmanship (3-views or published construction plans must be furnished judges)
6: Flying points awarded on a basis of "diminishing returns," i.e., one point per second up to 60, then one-half point a second to 120, one-fourth point a second to 180, etc.

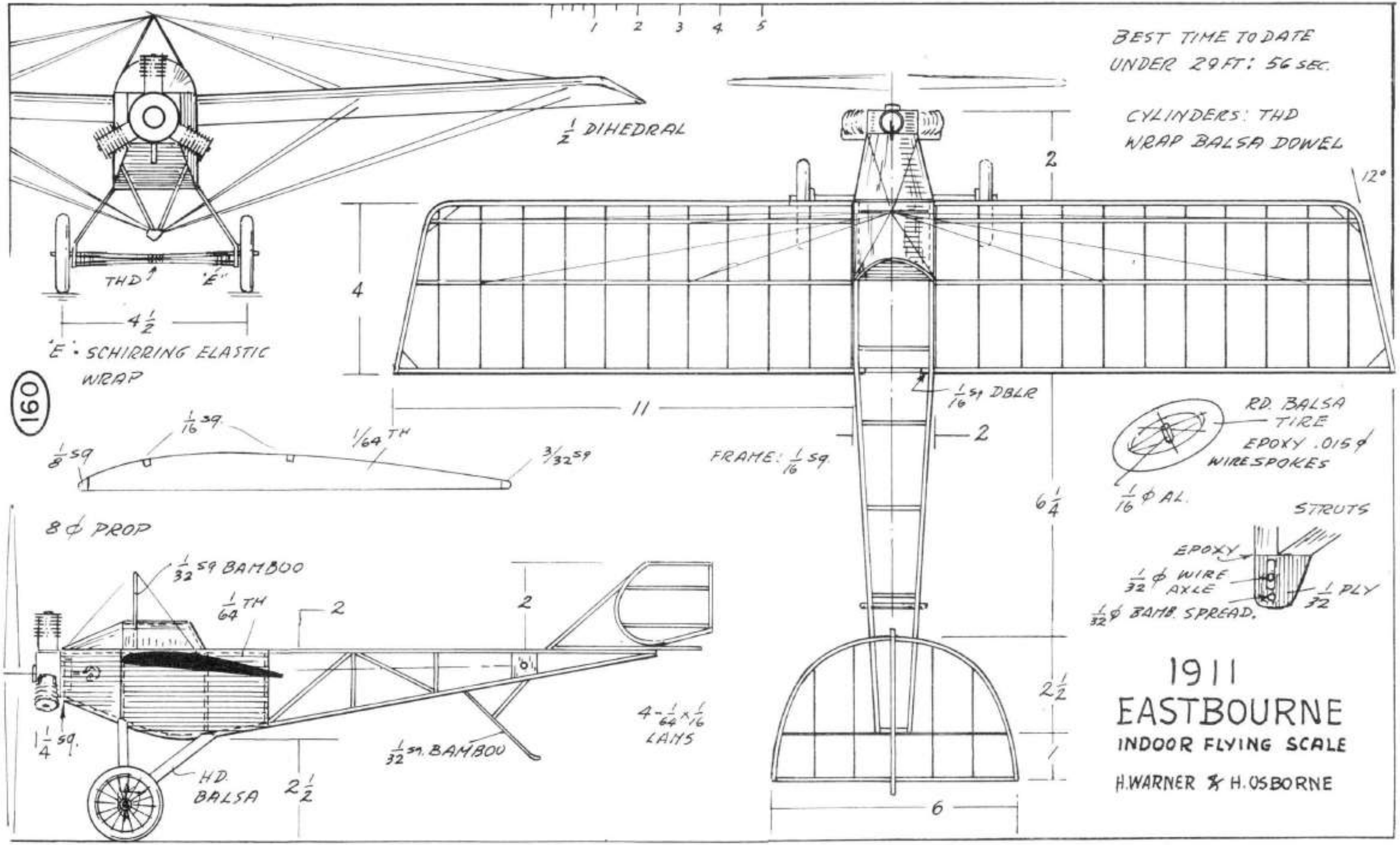
The WIMAC all-sheet rules are basically the same:

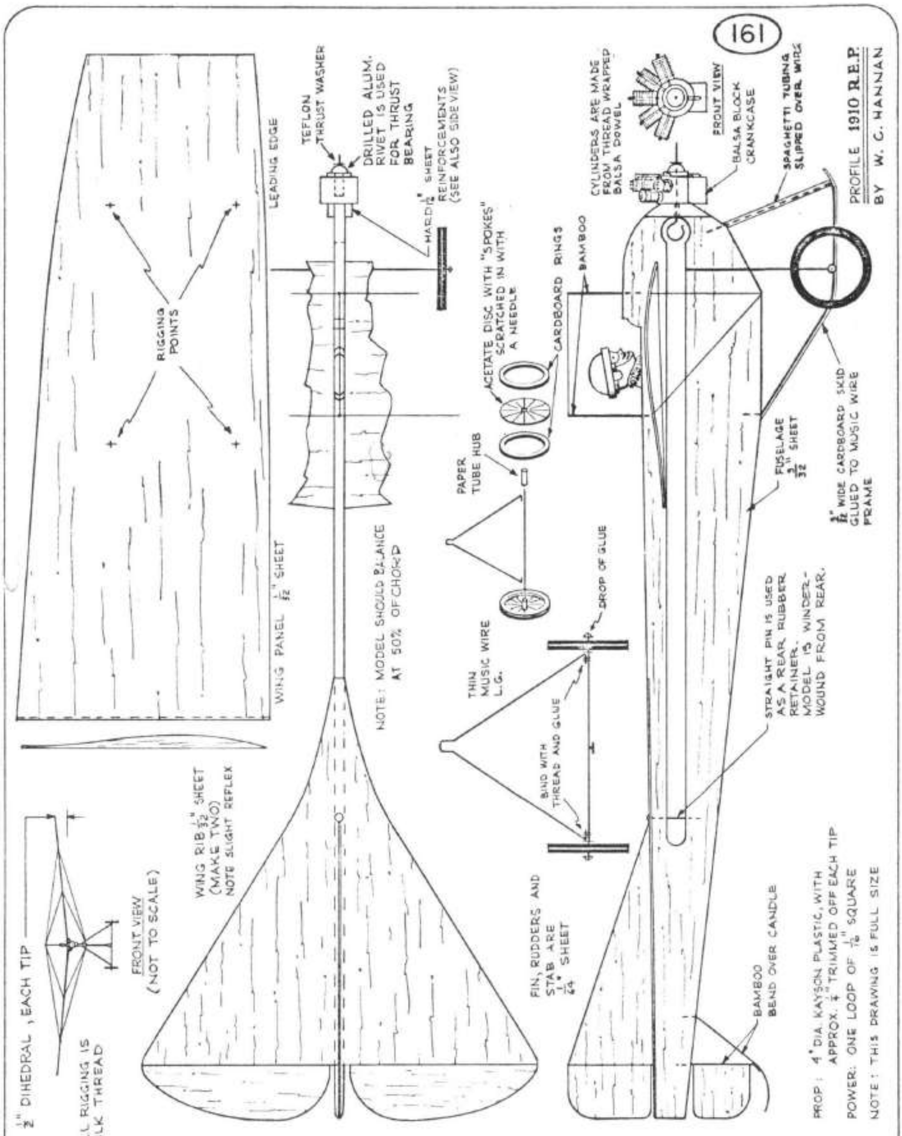
1: 24" maximum wingspan
2: Prop limited to 35% of span
3: Must be of all-sheet balsa construction (no tissue)
4: 50 workmanship points (only minimal proof that plane is scale necessary, such as photos, etc.) No profile fuselages, however.
5: Flying points awarded at one point per second.

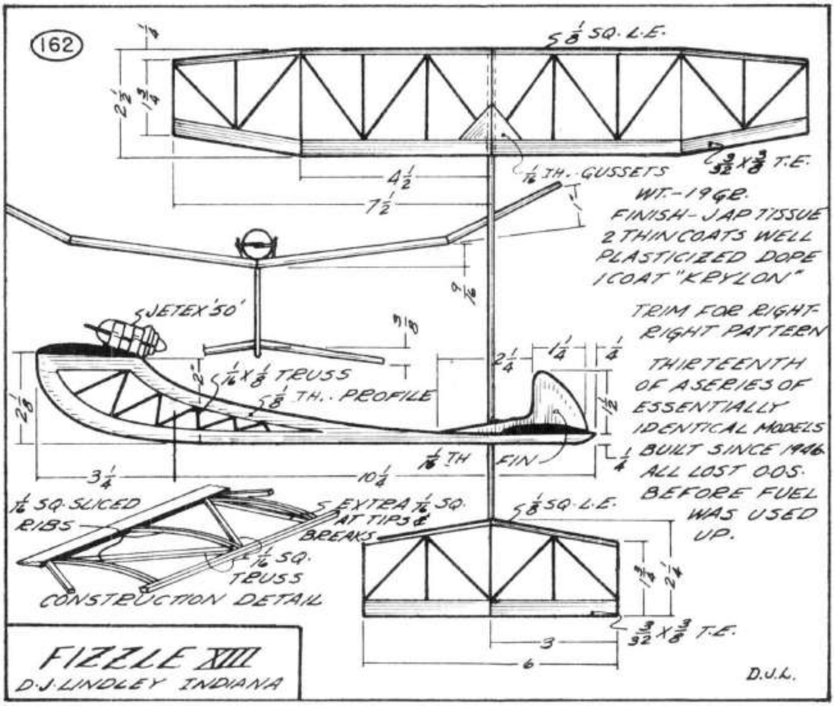
Both types must make a five-second minimum. Best flight time of four officials is added to scale/workmanship points.

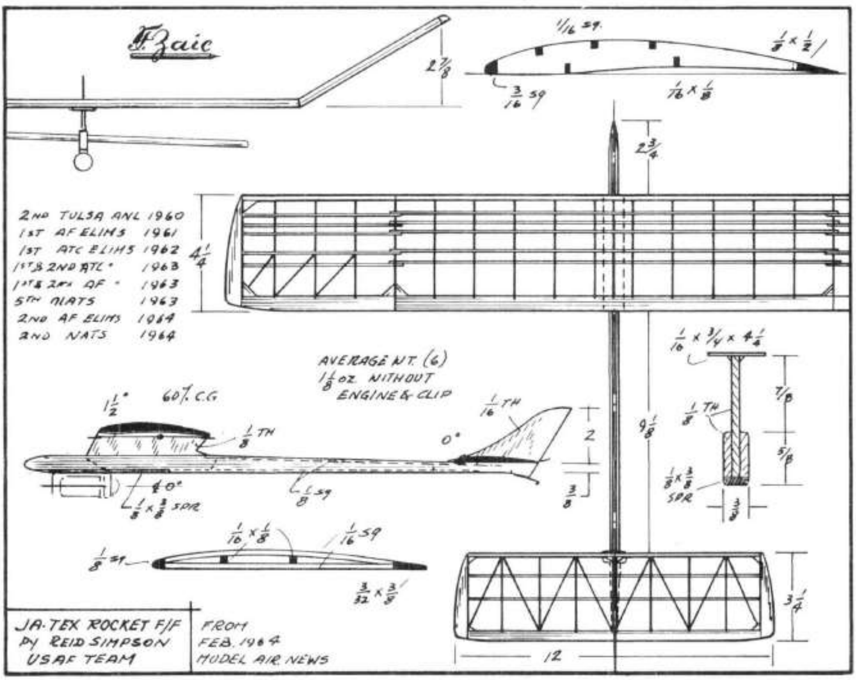
Monoplane and multiplane classes are flown.

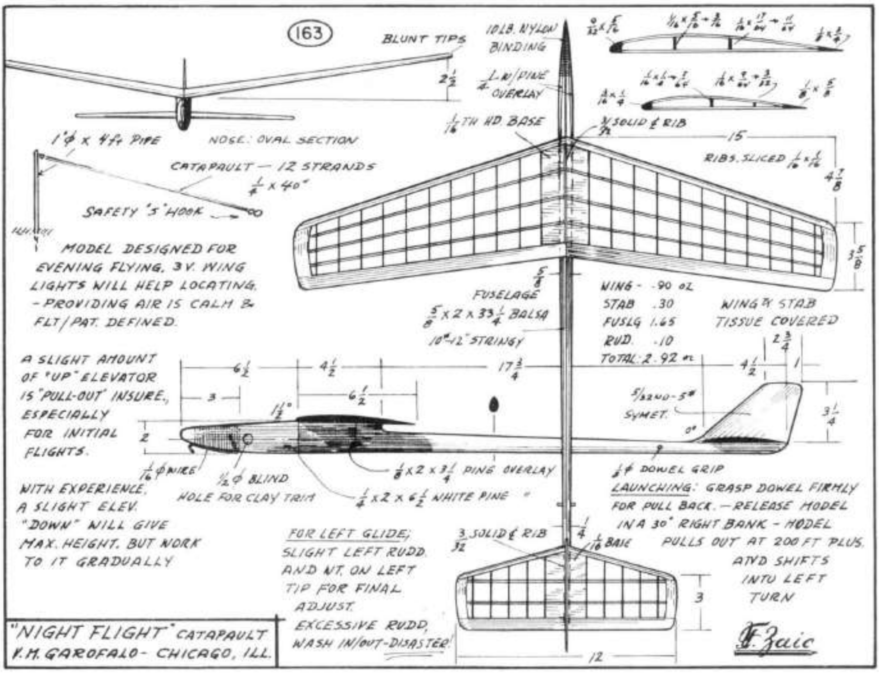
HINTS:
1. They are of very light (1/3 oz. to 1 oz.) construction.
2. Select 4-8 lb. balsa sheet used for sliced ribs, stringers.
3. Condenser paper used for covering, Dyed with aniline dyes or used plain on vintage craft.
4. Wing tips, stab and rudder outlines are laminated from 1/64" strips for strength and scale appearance.
5. Flights are made on prop-run alone, with little attention to glide. Start with a long motor and gradually shorten it until plane lands with prop just finishing its run.
6. C.G. usually well forward 30-40% depending on scale stab area. Lifting stabs and undercambered sections frequently used.
7. Right thrust and left rudder combination often used in combination with washed-in L.H. wing panel.
8. Fly left tight turn under low ceilings with left wing washed in just enough to keep tip off the floor while plane is using up excess initial power; plane will climb as torque wears down and circle will open up.
9. Use Pirelli rubber or Sig "power strip".

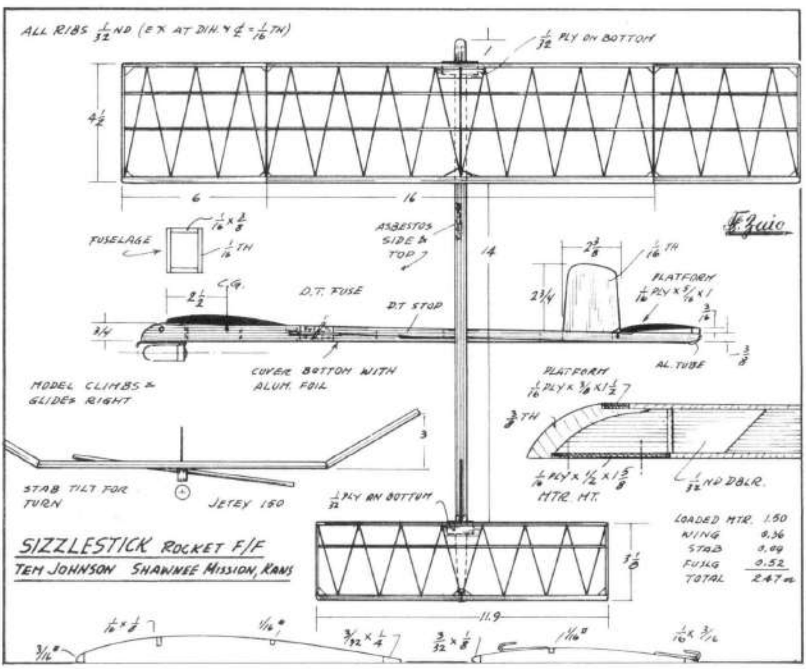

BEST TIME TO DATE
UNDER 29 FT: 56 SEC.
CYLINDERS: THD
WRAP BALSA DOWEL
1/2 DIHEDRAL
12°
THD
"E"
4 1/2
"E" - SCHIRRING ELASTIC
WRAP
160
1/16 SQ.
1/8 SQ
1/64 TH
3/32 SQ
FRAME: 1/16 SQ.
1/16 SQ DBLR
11
4
2
6 1/4
RD. BALSA
TIRE
EPOXY .015 ⌀
WIRESPOKES
1/16 ⌀ AL.
STRUTS
EPOXY
1/32 ⌀ WIRE
AXLE
1/32 PLY
1/32 ⌀ BAMB. SPREAD.
8 ⌀ PROP
1/32 SQ BAMBOO
1/64 TH
1 1/4 SQ.
HD.
BALSA
2 1/2
1/32 SQ. BAMBOO
4 - 1/64 × 1/16
LAMS
2 1/2
1
6
1911
EASTBOURNE
INDOOR FLYING SCALE
H.WARNER & H.OSBORNE


161
PROFILE 1910 R.E.P.
BY W. C. HANNAN
FRONT VIEW
CYLINDERS ARE MADE FROM THREAD WRAPPED BALSA DOWEL
BALSA BLOCK CRANKCASE
SPAGHETTI TUBING SLIPPED OVER WIRE
TEFLON THRUST WASHER
DRILLED ALUM. RIVET IS USED FOR THRUST BEARING
HARD 1/32" SHEET REINFORCEMENTS (SEE ALSO SIDE VIEW)
LEADING EDGE
RIGGING POINTS
ACETATE DISC WITH "SPOKES" SCRATCHED IN WITH A NEEDLE
CARDBOARD RINGS
BAMBOO
PAPER TUBE HUB
FUSELAGE 3/32" SHEET
1/32" WIDE CARDBOARD SKID GLUED TO MUSIC WIRE FRAME
DROP OF GLUE
THIN MUSIC WIRE L.G.
WING PANEL 1/32" SHEET
NOTE: MODEL SHOULD BALANCE AT 50% OF CHORD
STRAIGHT PIN IS USED AS A REAR RUBBER RETAINER. MODEL IS WINDER-WOUND FROM REAR.
BIND WITH THREAD AND GLUE
WING RIB 1/32" SHEET (MAKE TWO) NOTE SLIGHT REFLEX
FRONT VIEW (NOT TO SCALE)
1/2" DIHEDRAL, EACH TIP
ALL RIGGING IS SILK THREAD
FIN, RUDDERS AND STAB ARE 1/64" SHEET
BAMBOO BEND OVER CANDLE
PROP: 4" DIA. KAYSON PLASTIC, WITH APPROX. 1/4" TRIMMED OFF EACH TIP
POWER: ONE LOOP OF 1/16" SQUARE
NOTE: THIS DRAWING IS FULL SIZE


162
5 1/8 SQ. L.E.
1/16 TH. GUSSETS
3/32 X 3/8 T.E.
WT.-19 GR.
FINISH-JAP TISSUE
2 THIN COATS WELL
PLASTICIZED DOPE
1 COAT "KRYLON"
JETEX '50'
TRIM FOR RIGHT-
RIGHT PATTERN
1/16 X 1/8 TRUSS
1/8 TH.. PROFILE
THIRTEENTH
OF A SERIES OF
ESSENTIALLY
IDENTICAL MODELS
BUILT SINCE 1946
ALL LOST O.O.S.
BEFORE FUEL
WAS USED
UP.
1/16 TH
FIN
1/16 SQ. SLICED
RIBS
EXTRA 1/16 SQ.
AT TIPS &
BREAKS
1/16 SQ.
TRUSS
CONSTRUCTION DETAIL
1/8 SQ. L.E.
3/32 X 3/8 T.E.
FIZZLE XIII
D.J. LINDLEY INDIANA
D.J.L.


F. Zaic
1/16 SQ.
1/8 x 1/2
3/16 SQ
1/16 x 1/8
2ND TULSA ANL 1960
1ST AF ELIMS 1961
1ST ATC ELIMS 1962
1ST & 2ND ATC 1963
1ST & 2ND AF 1963
5TH NATS 1963
2ND AF ELIMS 1964
2ND NATS 1964
AVERAGE WT. (6)
1 1/8 OZ. WITHOUT
ENGINE & CLIP
60% C.G.
1/8 TH
1/16 TH
1/8 SQ
1/8 x 3/8 SPR
1/16 x 3/4 x 4 1/4
1/8 SQ.
1/16 x 1/8
1/16 SQ
3/32 x 3/8
JA-TEX ROCKET F/F
BY REID SIMPSON
USAF TEAM
FROM
FEB. 1964
MODEL AIR NEWS


163
BLUNT TIPS
10LB. NYLON BINDING
1/4 LW/PINE OVERLAY
1/16 TH HD. BASE
3/32 SOLID ¢ RIB
RIBS. SLICED 1/16 x 1/16
1"φ x 4ft PIPE
NOSE: OVAL SECTION
CATAPAULT — 12 STRANDS 1/4 x 40"
SAFETY "S" HOOK
MODEL DESIGNED FOR EVENING FLYING. 3V. WING LIGHTS WILL HELP LOCATING. - PROVIDING AIR IS CALM & FLT/PAT. DEFINED.
FUSELAGE 5/8 x 2 x 33 1/4 BALSA
10#-12" STRINGY
WING - .90 OZ
STAB .30
FUSLG 1.65
RUD. .10
TOTAL: 2.92 oz
WING & STAB TISSUE COVERED
A SLIGHT AMOUNT OF "UP" ELEVATOR IS "PULL-OUT" INSURE., ESPECIALLY FOR INITIAL FLIGHTS.
5/32 HD-5# SYMET.
1/16 φ WIRE
1/2 φ BLIND HOLE FOR CLAY TRIM
1/8 x 2 x 3 1/4 PINE OVERLAY
1/4 x 2 x 6 1/2 WHITE PINE
1/4 φ DOWEL GRIP
LAUNCHING: GRASP DOWEL FIRMLY FOR PULL BACK. — RELEASE MODEL IN A 30° RIGHT BANK - MODEL PULLS OUT AT 200 FT PLUS. AND SHIFTS INTO LEFT TURN
WITH EXPERIENCE, A SLIGHT ELEV. "DOWN" WILL GIVE MAX. HEIGHT. BUT WORK TO IT GRADUALLY
FOR LEFT GLIDE; SLIGHT LEFT RUDD. AND WT. ON LEFT TIP FOR FINAL ADJUST. EXCESSIVE RUDD, WASH IN/OUT-DISASTER!
3/32 SOLID ¢ RIB
1/16 BASE
"NIGHT FLIGHT" CATAPAULT
V.M. GAROFALO - CHICAGO, ILL.
F. Zaic


ALL RIBS 1/32 HD. (EX AT DIH. & ¢ = 1/16 TH)
1/32 PLY ON BOTTOM
FUSELAGE
1/16 x 3/8
1/16 TH
ASBESTOS SIDE & TOP
F. Zaic
C.G.
D.T. FUSE
D.T. STOP
PLATFORM 1/16 PLY x 5/16 x 1
AL. TUBE
COVER BOTTOM WITH ALUM. FOIL
MODEL CLIMBS & GLIDES RIGHT
PLATFORM 1/16 PLY x 3/8 x 1 1/2
1/16 PLY x 1/2 x 1 5/8 MTR. MT.
1/32 HD DBLR.
STAB TILT FOR TURN
JETEX 150
1/32 PLY ON BOTTOM
SIZZLESTICK ROCKET F/F
TOM JOHNSON SHAWNEE MISSION, KANS
LOADED MTR. 1.50
WING 0.36
STAB 0.09
FUSLG 0.52
TOTAL 2.47 oz

INDOOR H.L. GLIDER SECTION

Bill Gieskieng, Jr. Denver, Colo.

Winter time in Colorado is not designed for outdoor flying. So I switched to indoor and experimented with H. L. Gliders. I surprised everyone including myself when I won four contests in a row with my gliders. (First time, to my knowledge, anyone doing so in Colorado.)

The outstanding feature of my gliders that bugged most flyers is that while they thin the trailing edge to paper thickness, I built mine up to 3/32! This runs so contrary to modeling "instinct" that it takes a stop watch and several flights to convince most flyers that he is not nuts. Hal Blubaugh tested this idea on his glider at the last meet and topped his best previous efforts by several seconds. Hal showed up at the last Elims with a Wakefield so equipped. He calls it a "fence" while I call it a "kicker."

Pitch on my indoor section is weird. I have to use a more forward C.G. and considerable decalage to keep the glider from diving in launch. It takes an act of Congress and horrible tail warping to get even a suggestion of a loop. Stability in glide is amazing — the extra decalage needed for launch really shows up at the glide speed.

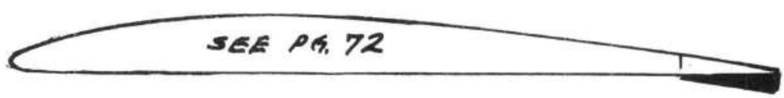
Unfortunately, this effect does not hold true for my outdoor versions, and I am still stuck with the 0-0 setting for them. Does the "kicker" slow up the climb? It seems to have no detrimental effects and I believe it enhances performance.

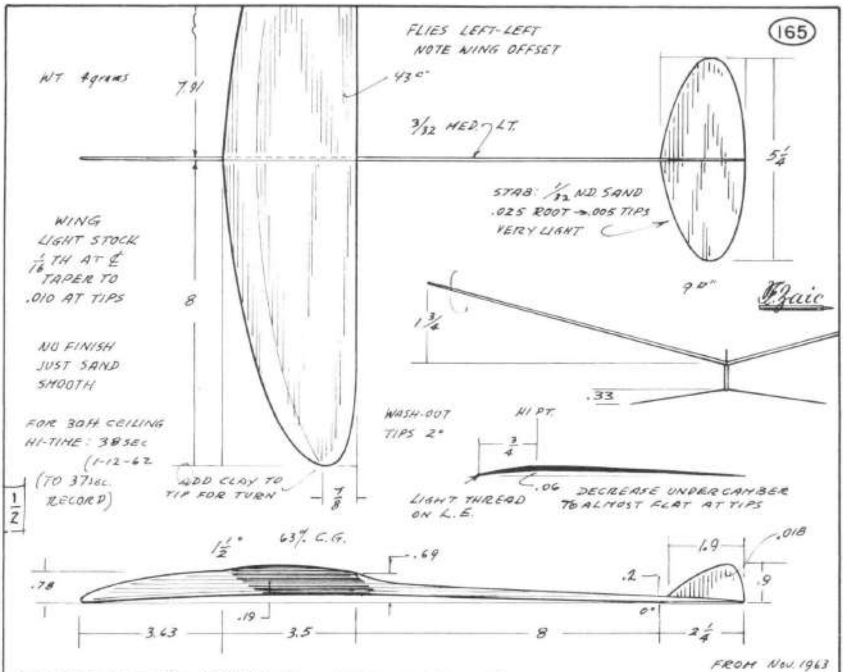
GIESKIENG INDOOR "KICKER" (APPROX.) 30→40FT.

BLUBAUGH'S "FENCE" EXACT LOCATION NOT CRIT.

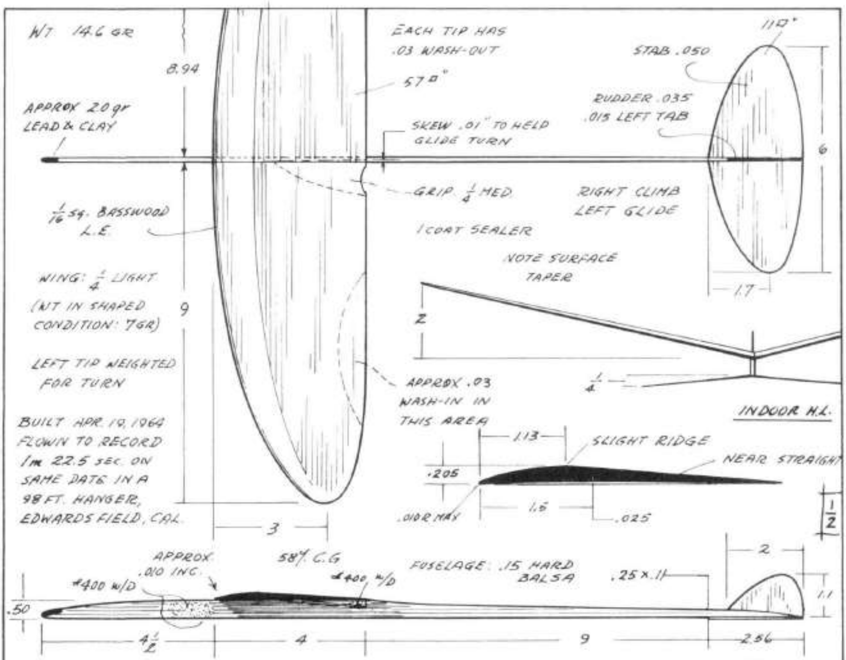
OUTDOOR VERSION

NOTE: Do not pass this "kicker" too quickly. Similar idea used for build-in "wash-in" adjustments Just cement enough trailing edge stock to obtain the required roll.

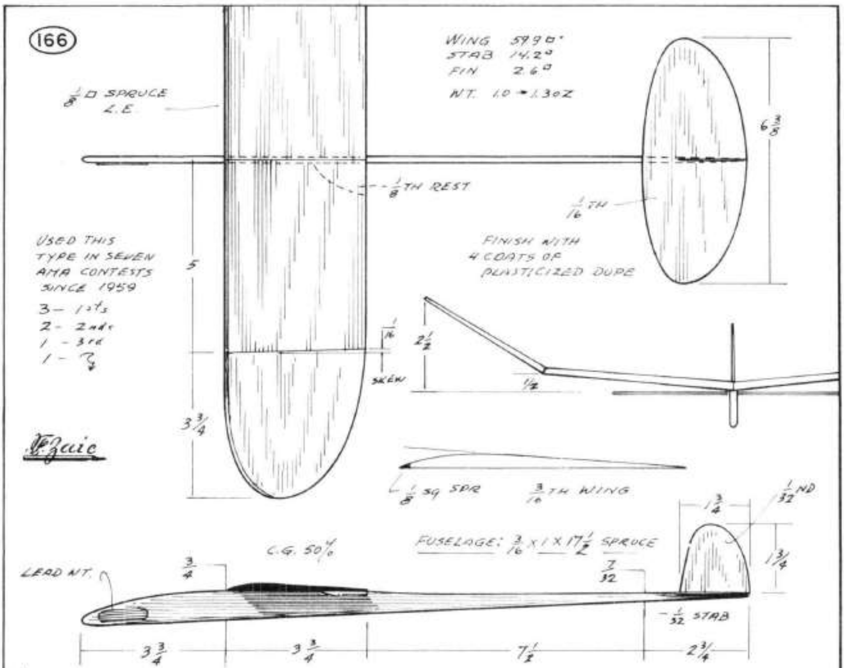




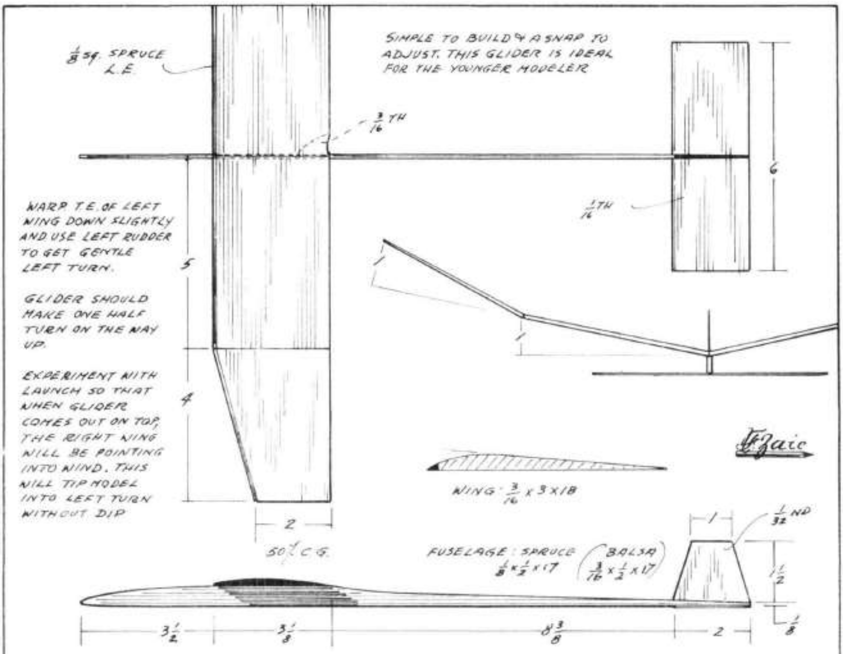
"SWEEPETTE 16" MK III — LEE R. HINES — TORRANCE, CALIF



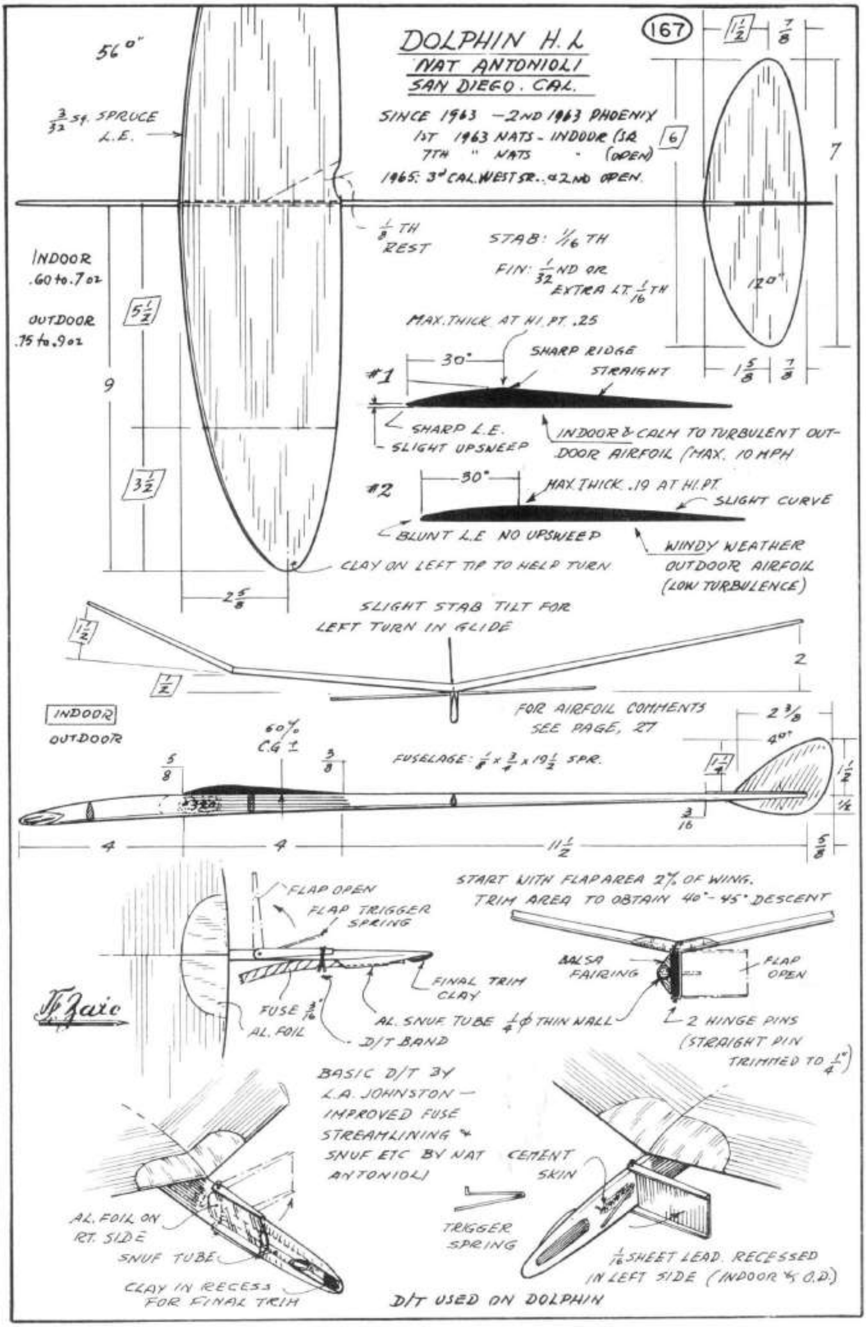
"SWEEPETTE" 18 MK 9 — LEE R. HINES — TORRANCE, CALIF.



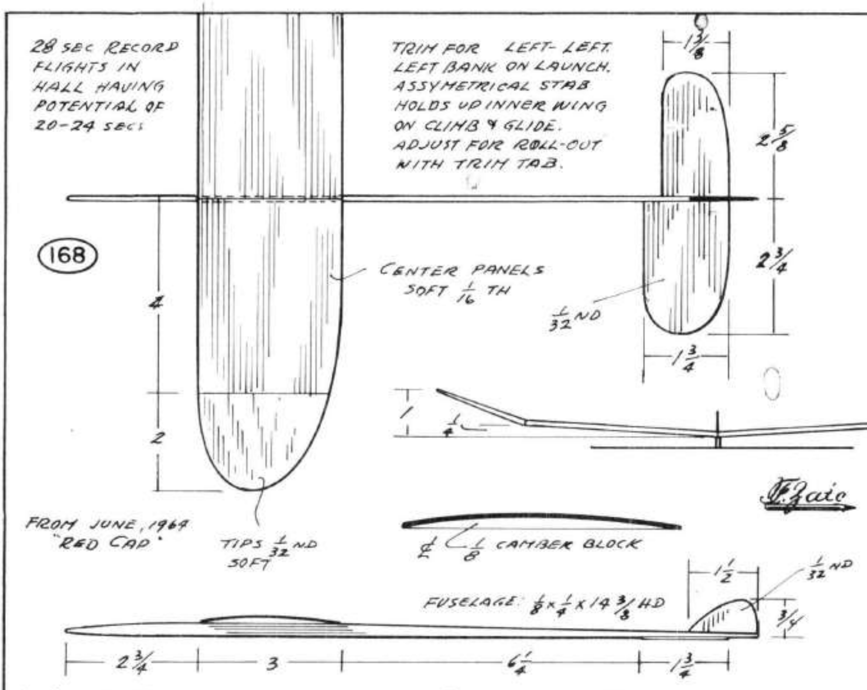
"BRONCO" H.L. OUTDOOR GLIDER — TEM JOHNSON — KANSAS CITY, MO. —



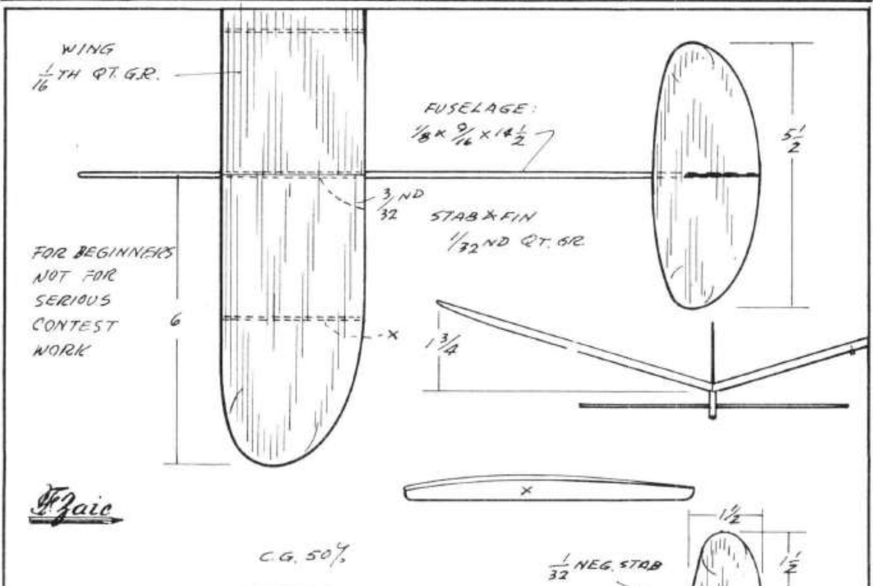
OUTDOOR H.L. GLIDER FOR BEGINNERS — VAN HEREFORD — BATON ROUGE, LA.



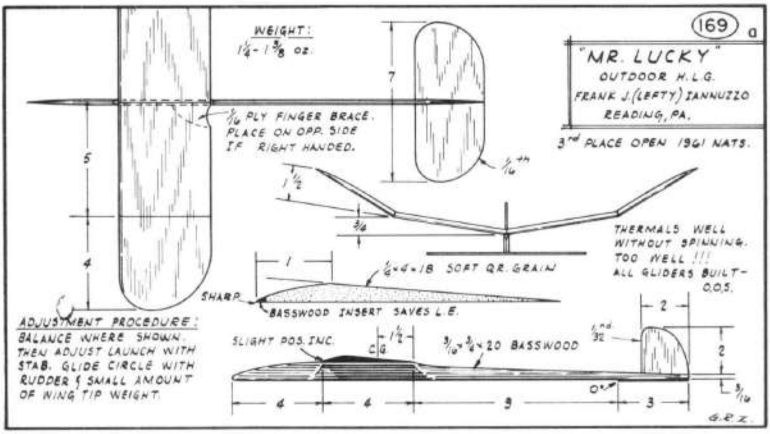
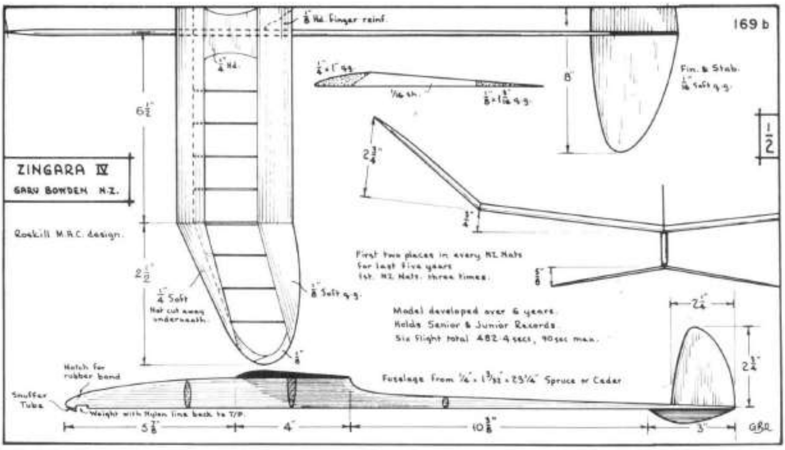
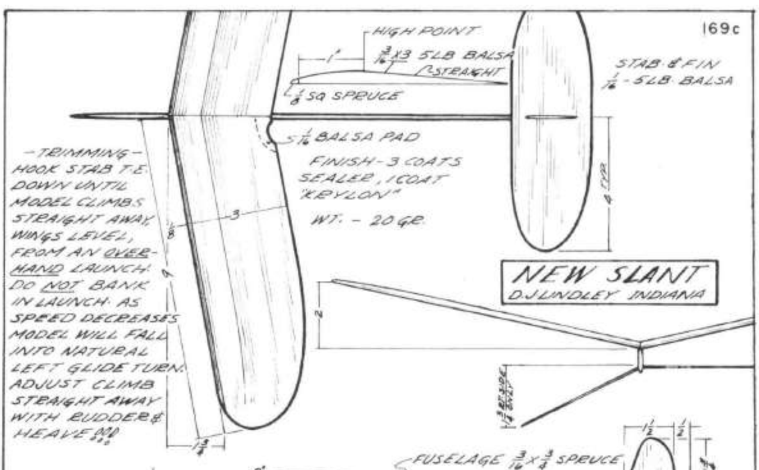
167
DOLPHIN H. L.
NAT ANTONIOLI
SAN DIEGO. CAL.
SINCE 1963 — 2ND 1963 PHOENIX
1ST 1963 NATS - INDOOR (SR
7TH " NATS - (OPEN)
1965: 3rd CAL.WEST SR.. & 2ND OPEN.
56.0"
3/32 sq. SPRUCE L.E.
1/8 TH REST
STAB: 1/16 TH
FIN: 1/32 ND OR EXTRA LT. 1/16 TH
INDOOR .60 to .7 oz
OUTDOOR .75 to .9 oz
12.0"
MAX. THICK AT HI. PT. .25
SHARP RIDGE
STRAIGHT
#1
SHARP L.E.
SLIGHT UPSWEEP
INDOOR & CALM TO TURBULENT OUTDOOR AIRFOIL (MAX. 10 MPH
#2
MAX. THICK .19 AT HI. PT.
SLIGHT CURVE
BLUNT L.E. NO UPSWEEP
WINDY WEATHER OUTDOOR AIRFOIL (LOW TURBULENCE)
CLAY ON LEFT TIP TO HELP TURN
SLIGHT STAB TILT FOR LEFT TURN IN GLIDE
FOR AIRFOIL COMMENTS SEE PAGE, 27
INDOOR
OUTDOOR
60% C.G.
FUSELAGE: 1/8 x 3/4 x 19 1/2 SPR.
START WITH FLAP AREA 2% OF WING. TRIM AREA TO OBTAIN 40°- 45° DESCENT
FLAP OPEN
FLAP TRIGGER SPRING
FINAL TRIM CLAY
FUSE 3/16
AL. FOIL
AL. SNUF TUBE 1/4 ϕ THIN WALL
D/T BAND
BALSA FAIRING
FLAP OPEN
2 HINGE PINS (STRAIGHT PIN TRIMMED TO 1/4")
BASIC D/T BY L.A. JOHNSTON — IMPROVED FUSE STREAMLINING & SNUF ETC BY NAT ANTONIOLI
CEMENT SKIN
AL. FOIL ON RT. SIDE
SNUF TUBE
CLAY IN RECESS FOR FINAL TRIM
TRIGGER SPRING
1/16 SHEET LEAD. RECESSED IN LEFT SIDE (INDOOR & O.D.)
D/T USED ON DOLPHIN



INDOOR CHUCK GLIDER— DAVE GOODWIN — ENGLAND



LOW CEILING H.L. GLIDER— TEM JOHNSON— KANSAS CITY, MO.—


169 a
"MR. LUCKY"
OUTDOOR H.L.G.
FRANK J. (LEFTY) IANNUZZO
READING, PA.
3rd PLACE OPEN 1961 NATS.
WEIGHT: 1¼ - 1⅜ OZ.
1/16 PLY FINGER BRACE. PLACE ON OPP. SIDE IF RIGHT HANDED.
5
4
7
1/16th
1½
¾
THERMALS WELL WITHOUT SPINNING. TOO WELL !!!
ALL GLIDERS BUILT - O.O.S.
1
¼×4×18 SOFT QR. GRAIN
SHARP
BASSWOOD INSERT SAVES L.E.
ADJUSTMENT PROCEDURE: BALANCE WHERE SHOWN. THEN ADJUST LAUNCH WITH STAB. GLIDE CIRCLE WITH RUDDER & SMALL AMOUNT OF WING TIP WEIGHT.
SLIGHT POS. INC.
CG
1½
3/16×¾×20 BASSWOOD
1/32
2
2
0°
3/16
4
4
9
3
G.R.Z.

169 b
⅛ Hd. finger reinf.
¼ Hd.
¼×1" q.g.
1/16 sh.
⅛×1/16 q.g.
8"
Fin & Stab. 1/16 Soft q.g.
1/2
6½"
2¾"
ZINGARA IV
GARY BOWDEN N.Z.
Roskill M.A.C. design.
2½"
¼ Soft
Not cut away underneath.
⅛ Soft q.g.
First two places in every NZ Nats for last five years
1st. NZ Nats. three times.
⅝"
Model developed over 6 years.
Holds Senior & Junior Records.
Six flight total 482.4 secs, 90 sec max.
2¼"
2¾"
Notch for rubber band
Snuffer Tube
Fuselage from ¼"×1 3/32×23¼" Spruce or Cedar
Weight with Nylon line back to T/P.
5⅞"
4"
10⅜"
3"
GBR

169c
HIGH POINT
1"
3/16 X3 5LB BALSA
STRAIGHT
⅛ SQ SPRUCE
STAB & FIN 1/16 - 5LB. BALSA
1/16 BALSA PAD
FINISH - 3 COATS SEALER, 1 COAT "KRYLON"
WT. - 20 GR.
4 TYP.
- TRIMMING - HOOK STAB T.E. DOWN UNTIL MODEL CLIMBS STRAIGHT AWAY, WINGS LEVEL, FROM AN OVER-HAND LAUNCH. DO NOT BANK IN LAUNCH. AS SPEED DECREASES MODEL WILL FALL INTO NATURAL LEFT GLIDE TURN. ADJUST CLIMB STRAIGHT AWAY WITH RUDDER & HEAVE HO
3
9
NEW SLANT
D.J. LINDLEY INDIANA
2
1¾
FUSELAGE 3/16 X ¾ SPRUCE
1½
½
0°
0°
3
3
7½
3/16
2½
D.J.L.

DESIGNING MODEL HELICOPTERS

Bruno Horstenke Germany

(This is an extract from his article, and only the portion essential to model helicopter design is given.)

The degree of difficulty in building a model helicopter is about the same as building a powered model, and success is assured by following basic design proportions.

I found that the best results are obtained, even under adverse weather conditions, by installing the engine inside the fuselage with prop below. By doing so, the prop wash has negligible effect on the rotation of the fuselage. The lower C.G. obtained by this installation also improves the over stability in contrast to other engine and rotor arrangements. No special stabilizing elements are needed to keep the fuselage from turning.

For blades I prefer to use double trapeze outline with about 7% Clark Y airfoil. — Full size helicopters have Blade-Area/Rotor-Area ratios between 4 to 8%. For model helicopters I found that a ratio of about 10% is good. — Rotor Area load for full size craft is 10 to 40 kgs. per sq. meter (2-8 lbs. per sq. ft.). While for models it may vary between 5 to 10 grams per sq. decimeter (3.5 to 7 oz. per sq. ft.). And the load on the Blades is 200 to 300 kg. per sq. meter (44 to 65 lbs. per sq. ft.) on full scale, and 50 to 100 grams per sq. decimeter (35 to 70 oz. per sq. ft.) on model blades.

Horse Power requirements can be found from this approximate formula, (In metric system.):

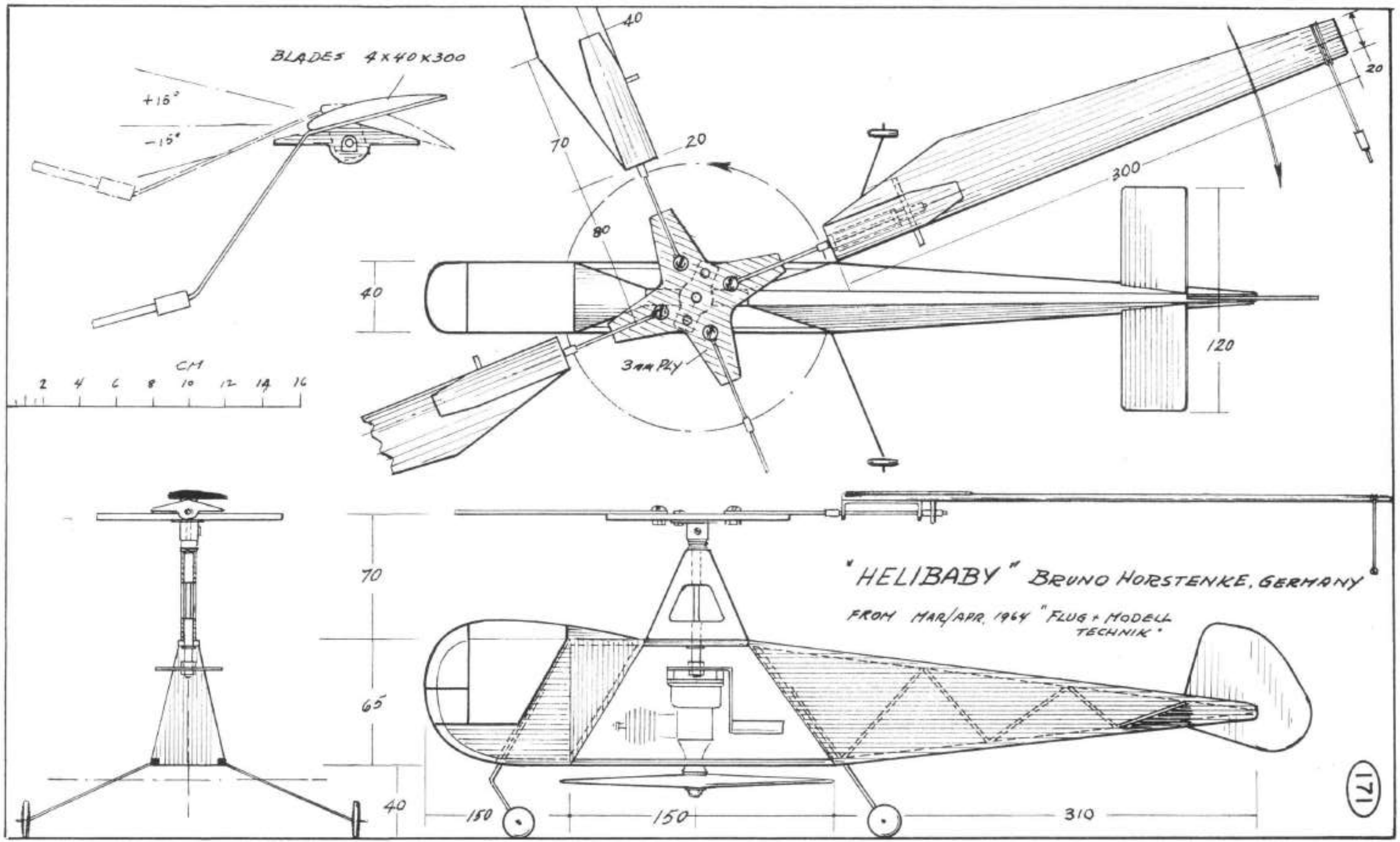
$$\text{H.P.} = 0.2 \times \text{Weight (kg.)}$$

Example: A 1000 kg. helicopter requires 200 H.P.
(2200 lb. helicopter requires 200 H.P.)

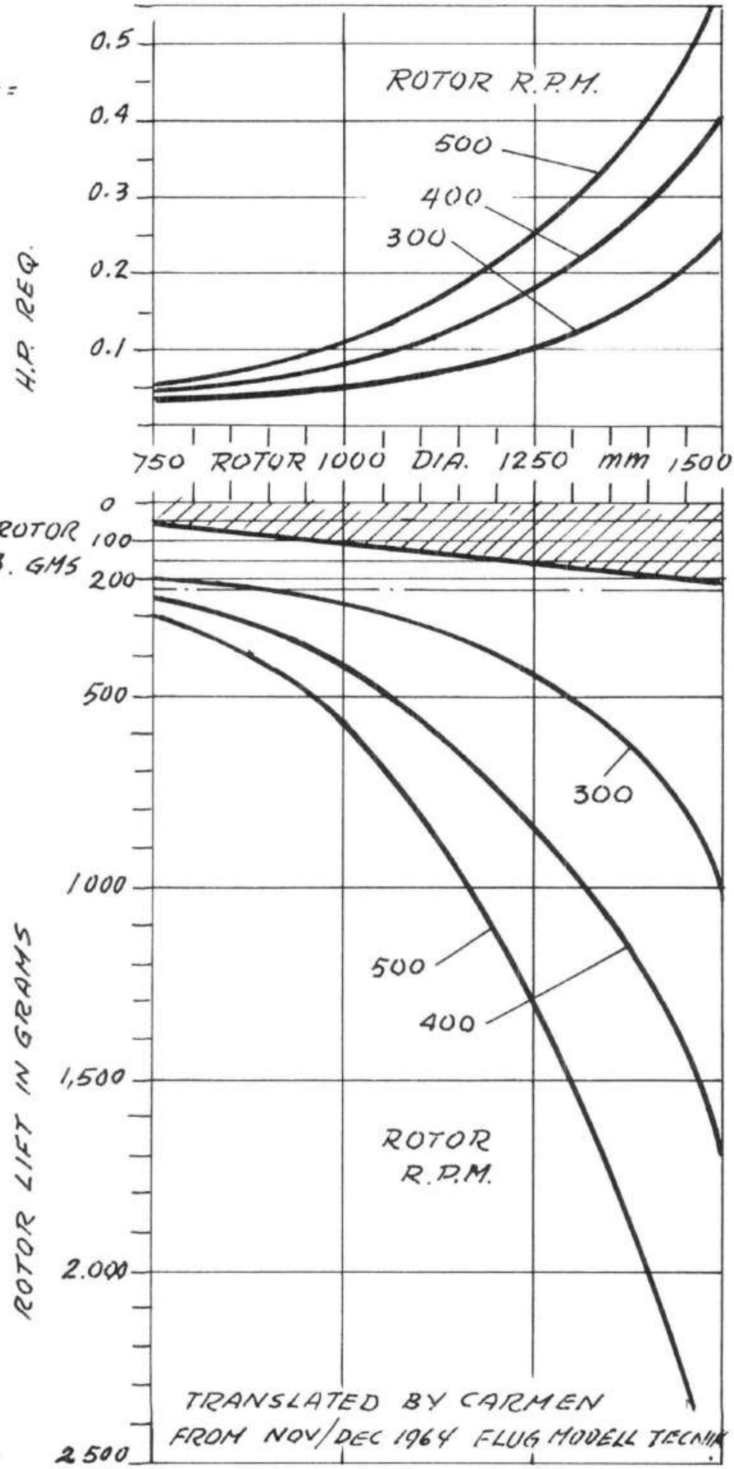
Applied to models and using "Heliobaby" as an example; "Heliobaby" weighs 0.25 kg. (9 ozs.). Req. H.P. = 0.2 x 0.25 or 0.05 H.P. The Cox BABE BEE which powers the "Heliobaby" has 0.056 H.P. at 15400 R.P.M. Practice has proven that the model rises satisfactory with this relatively low power.

To obtain a better understanding of the relationship of individual values to each other, see graph. Understandably, the calculations may be rough or approximate but they do give good base for designing your own helicopter model. The graphs are based on total Blade Area being 10% of the Rotor Area.

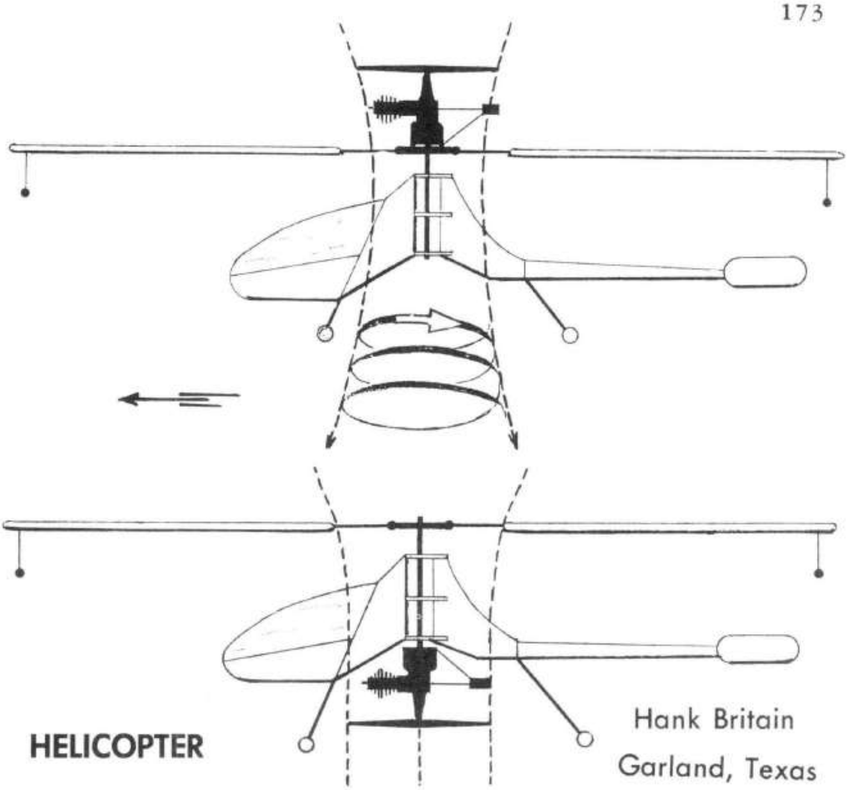
To check the Graph let us use "Heliobaby" as an example. — It has a Rotor Dia. of 750 mm (30 in.), Powered by 0.056 H.P. engine, and rotor weighs 80 g, (2.75 oz.). These characteristics will cause the Rotor to rotate at about 500 R.P.M. and generate 300 g (10 oz.) of lift. More than needed to lift 250 g.



"HELIBABY" BRUNO HORSTENKE, GERMANY
FROM MAR/APR. 1964 "FLUG + MODELL TECHNIK"
BLADES 4 x 40 x 300
+15°
-15°
3mm PLY
CM
2 4 6 8 10 12 14 16
300
120
40
20
70
80
65
150
310
171



A 1000 mm Rotor Dia. model "RECORD" with five blades was also checked against the graph and found to agree with the values shown.



HELICOPTER

Hank Britain
Garland, Texas

Torque reaction models have come to be known for their bad tendency to roll in inverted unless perfectly balanced. The DUCK, during its many flights, has never shown any tendency to roll in, even when large changes in the position of the CG have been imposed on it for test purposes.

The ducted prop takes the prop blast off the fuselage of the model and eliminates the turning effect of the prop wash. The ducted prop also provides more thrust, in this case more lift. Because of the low position of the prop blast, air passing over the fuselage is relatively burble free, thus making it possible to control the direction of forward flight with the movable rudder. When the model is trimmed for forward flight, deflecting the rudder to right or left will cause the model to fly in that direction, the amount of turn being controlled entirely by the amount of rudder deflection.

The model will fly to follow any center of gravity shift, weight on the nose results in forward flight, etc. I hasten to point out, however, that the model will not fly sideways or backward in the "pure" sense of the word. The weather vane action of the fuselage reacts to increase of wind velocity from the side (etc.) by simply aligning itself with the new relative wind.

Probably the most outstanding characteristic of this design is that the model cannot be upset in the air by excessive CG displacement. If the weight can be lifted, it will be lifted up.

The large rotor is allowed to "see-saw," with small springs acting as shock absorbers. The idea for the rotor came from an article by Roy L. Clough, Jr., published in the October 1953 issue of "AIR TRAILS." He called his system "C. G. Rig Control, Bungee Dynamic Series." My modification of his system makes autorotation possible when power is off. The blades are connected by a light piece of piano wire which passes through a small copper tube, which in turn passes through three larger tubes, giving the unit strength. The wire serves as a torsion-bar-tension-hinge, which allows the blades to pivot while maintaining their relative angular relationships and the blades are still free to change their angular relationships to each other. The inherent resistance to twisting of the wire causes the blades to move together when coriolis forces cause the blades to "see-saw." Thus, the blades assume positive pitch on one side and negative on the other. This occurs 90 degrees ahead of the result, making gyroscopic precession work to stabilize the model.

The large rotor blades are connected to the drive shaft by a "dog-override" which allows the blades to free-wheel, disengaged from the drive shaft when the engine is not running. This means that the rotor will absorb less energy during autorotation, thus allowing this energy to be used in providing a slower rate of descent.

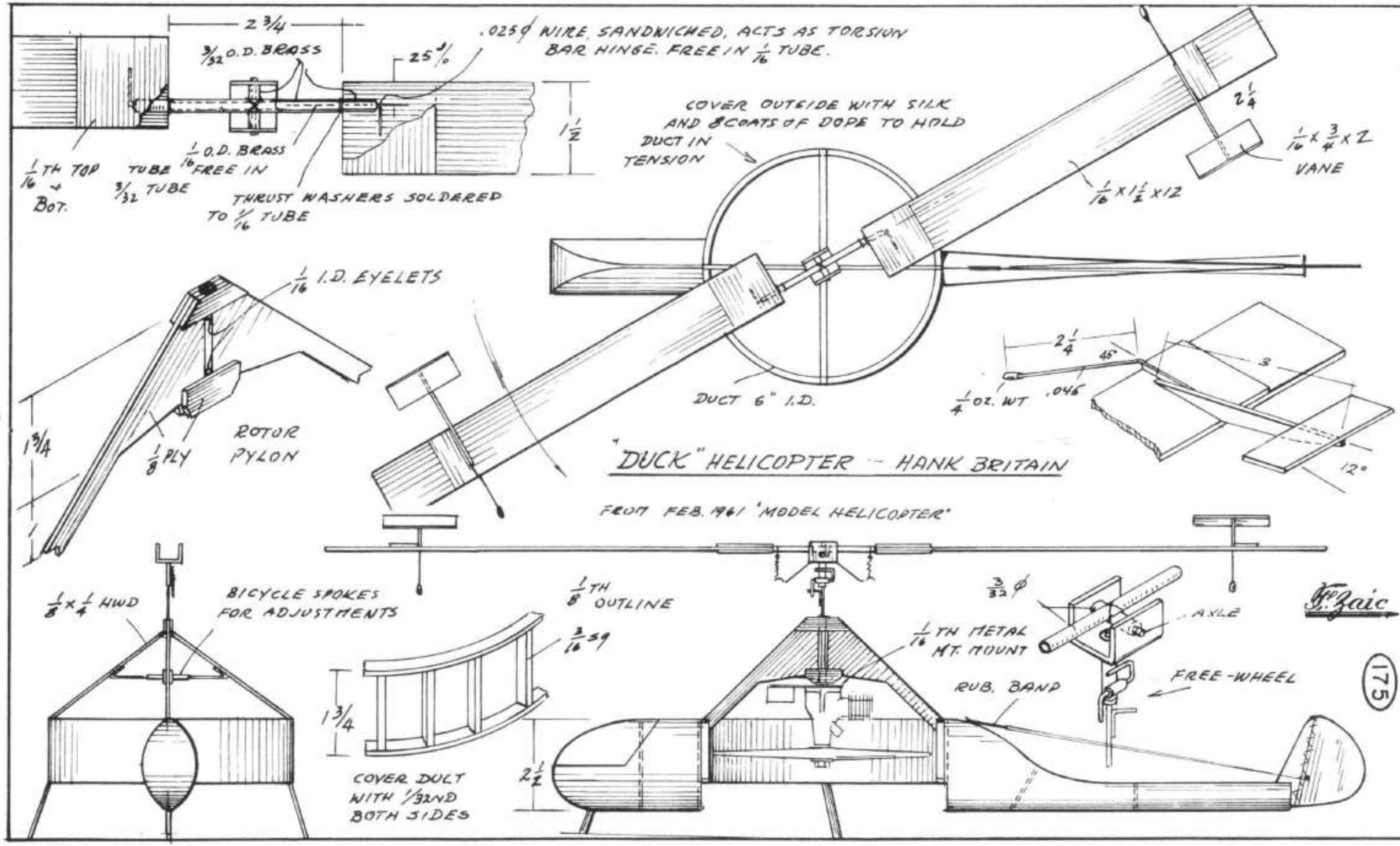
The blades have weights similar to most torque reaction designs, in addition each blade is fitted with an elevator type flap, which I have developed from past models. This combination of weights and flaps ensures positive pitch under power, yet assumes that negative pitch will be at an absolute minimum when power is off. This model has the slowest autorotational rate of descent of any of the models to date.

Balance the fuel tank, engine unit separately from the main rotor. The fuel tank provides the necessary weight for balancing the cylinder. Rotor balance is very important and should be carefully checked periodically.

Actual construction is detailed on the drawings and should present little problem for the intermediate and experienced beginner. Care should be taken to keep the weight as low as possible. A light model will be able to climb higher and descend more slowly than a heavy model. Be extremely careful when assembling all rotating parts; the weight of each part will increase several times over during rotation; poorly assembled units may come apart.

With a full tank of fuel the engine will run for about two minutes and forty seconds. Test flights should be attempted with a short motor run but under FULL POWER. With a forty second motor run and a flying weight of six ounces my model will climb to about 200 feet. Several times I have flown the model with a full tank. It became a speck in the sky and the long vertical glide is really a sight to see. This model may be capable of thermal flight.

This design may be suitable for radio control and with a torque controlling device might be capable of true sideways and reward flight.



2 3/4
3/32 O.D. BRASS
25%
.025 ⌀ WIRE SANDWICHED, ACTS AS TORSION BAR HINGE. FREE IN 1/16 TUBE.
1 1/2
1/16 TH TOP + BOT.
1/16 O.D. BRASS TUBE FREE IN 3/32 TUBE
THRUST WASHERS SOLDERED TO 1/16 TUBE
COVER OUTSIDE WITH SILK AND 8 COATS OF DOPE TO HOLD DUCT IN TENSION
2 1/4
1/16 x 3/4 x 2
VANE
1/16 x 1 1/2 x 12
1/16 I.D. EYELETS
1 3/4
1/8 PLY
ROTOR PYLON
DUCT 6" I.D.
2 1/4
45°
3
1/4 OZ. WT
.046
12°
"DUCK" HELICOPTER — HANK BRITAIN
FROM FEB. 1961 "MODEL HELICOPTER"
1/8 x 1/4 HWD
BICYCLE SPOKES FOR ADJUSTMENTS
1/8 TH OUTLINE
3/16 sq
1 3/4
COVER DUCT WITH 1/32ND BOTH SIDES
2 1/2
1/16 TH METAL MT. MOUNT
3/32 ⌀
AXLE
RUB. BAND
FREE-WHEEL
F. Zaic

UNCLE IGOR HELICOPTER

Dr. D. Lee Taylor Denver, Colo.

Uncle Igor was originally powered by an Arden .099 engine of 1947 vintage. The first few flights were not successful since the tip-weight-type rotor system lacked the necessary stability and lift for Uncle Igor's weight.

In the Fall of 1960 my first Gyrocyclic rotor system was built and tried with the Arden .099 and Uncle Igor. The success of this combination was instantaneous and although several attempts were made to build a better model for the helicopter event at the 1961 Nats, none were any where near the ability of Uncle Igor. Uncle Igor was chosen for the 1961 Nats.

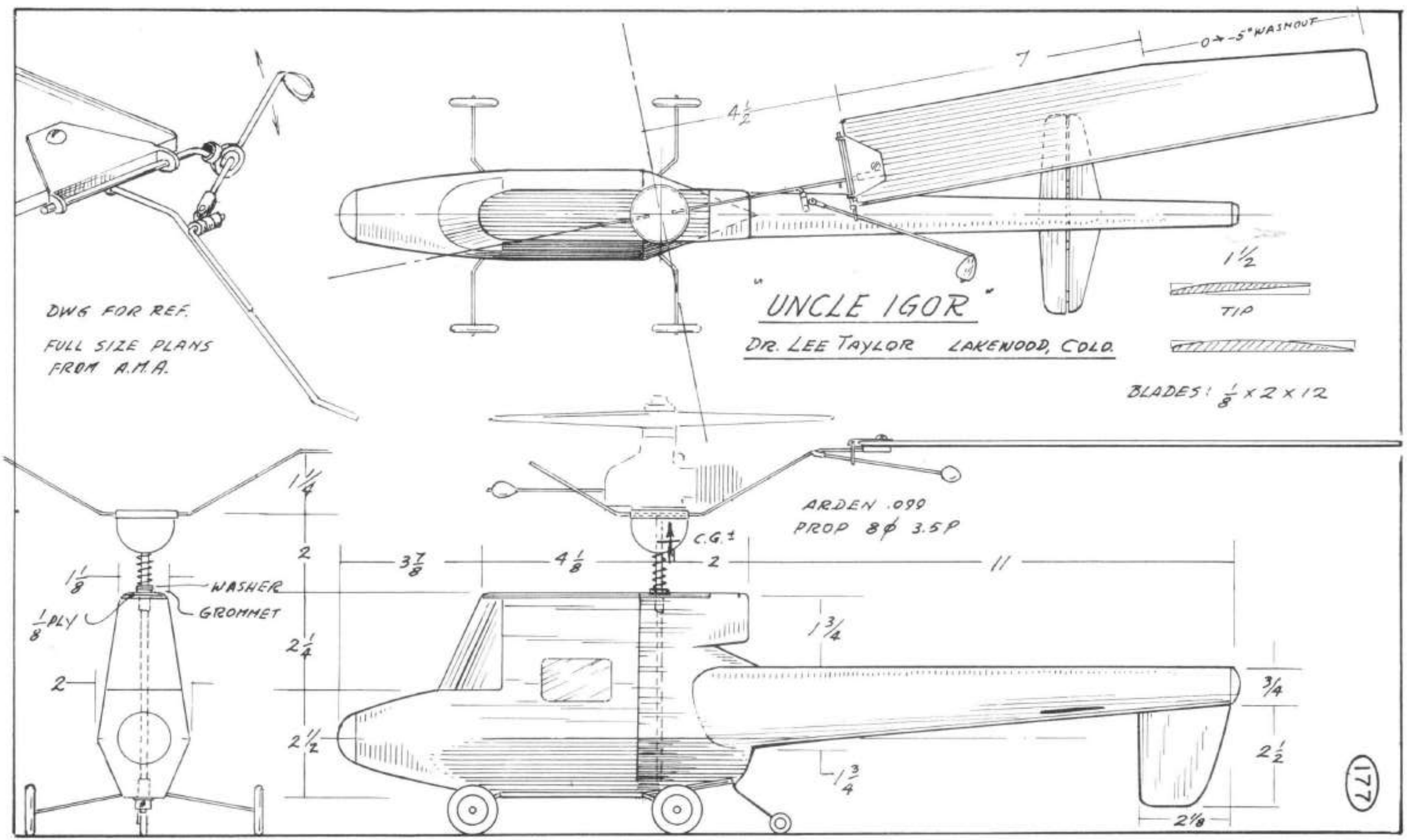
At the 1961 NATS on the first official flight Uncle Igor was up to an unprecedented 5½-minute flight and easily outdistanced his retriever (me). He flew beyond the air base fence. By the time I found a good place to scale the fence, and searched for half an hour, I decided to report the loss. When arriving at AMA Headquarters there sat Uncle Igor who had been picked up at the side of the highway by a couple of Naval officers. Several more flights of shorter duration were made and proved sufficient for Uncle Igor to win the first-place trophy.

By this time Uncle Igor had wanderlust. One September day in 1962 at high noon during a demonstration flight at a contest in Aurora, Colo., he climbed rapidly into the sun and although he could not be seen, the sound of his engine faded in the distance. From the evidence gathered later it was concluded that he got into a strong thermal which greatly extended the usual rate of descent and Uncle Igor was O.O.S.

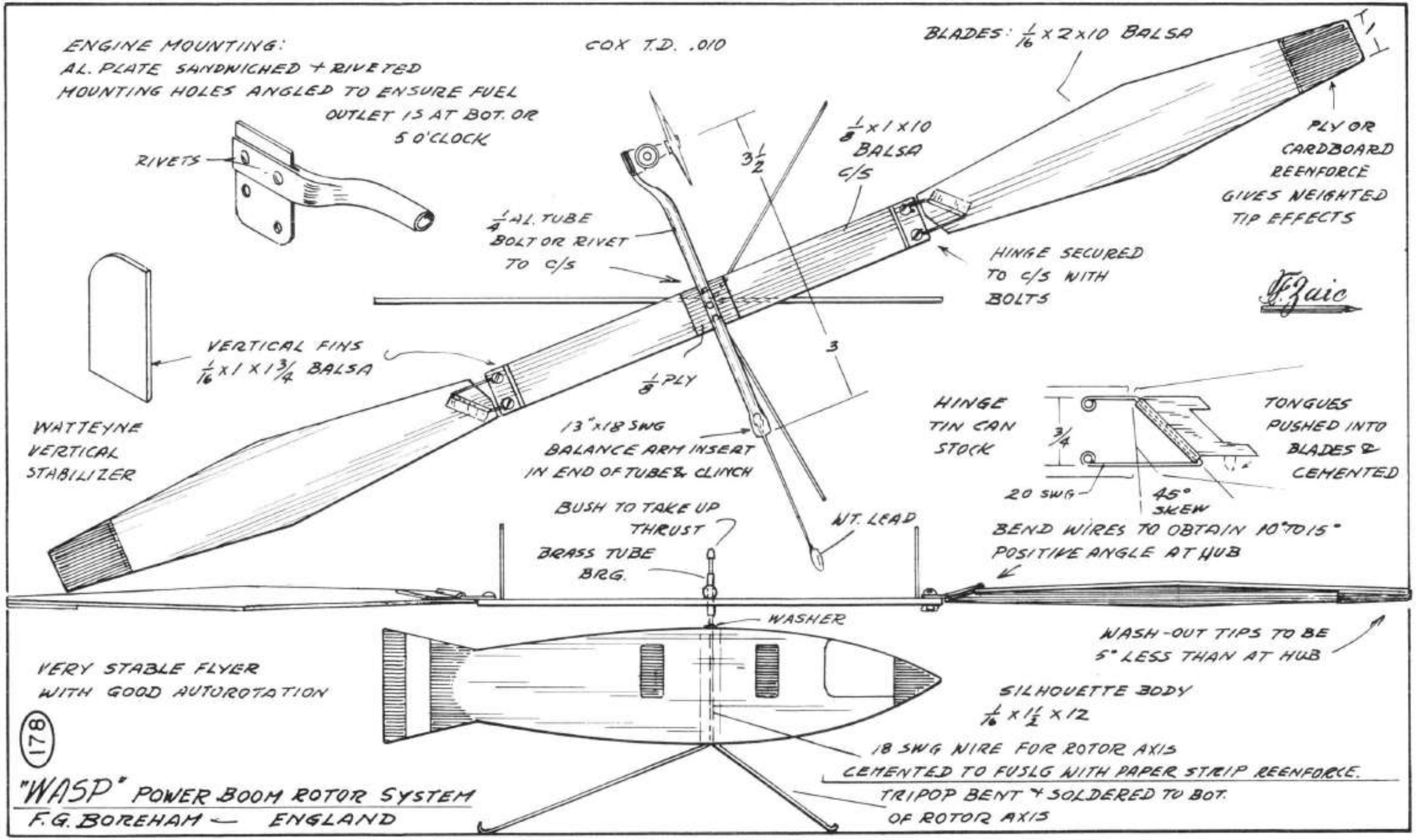
In March of 1963 a farmer found him better than 2½ miles from the takeoff site. The only damage from the winter in the open was a hole in the nose, and one in the tail boom chewed by a field mouse as an entrance to our mouse friend's unusual winter shelter.

True to the reputation of the infamous bad penny's returning I have not yet decided to rename Uncle Igor "Bad Penny" and continue to add to his 250 plus flights; or to grant him elder statesman status and retire him to non-flying exhibition in my hobby room.

Regardless of whichever decision I come to, Uncle Igor has done much to get model helicopter building and flying in my blood. This interesting phase of modeling is fascinating and challenging. Model helicopters merit the consideration of the modeler who has felt himself become stale on modeling and is looking for something new.



"UNCLE IGOR"
DR. LEE TAYLOR LAKEWOOD, COLO.
DWG FOR REF.
FULL SIZE PLANS FROM A.M.A.
0 → -5° WASHOUT
7
4 1/2
1 1/2
TIP
BLADES: 1/8 × 2 × 12
ARDEN .099
PROP 8 Ø 3.5 P
C.G. ±
WASHER
GROMMET
1/8 PLY
1 1/8
1 1/4
2
2 1/4
2 1/2
3 7/8
4 1/8
11
1 3/4
3/4
2 1/8
177

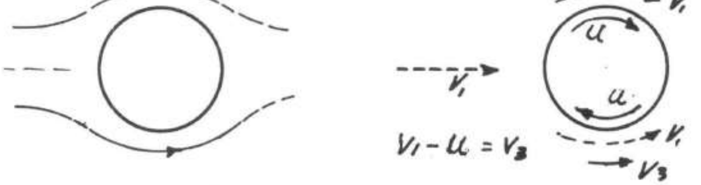

ENGINE MOUNTING:
AL. PLATE SANDWICHED + RIVETED
MOUNTING HOLES ANGLED TO ENSURE FUEL OUTLET IS AT BOT. OR 5 O'CLOCK
RIVETS
COX T.D. .010
BLADES: 1/16 x 2 x 10 BALSA
1/8 x 1 x 10 BALSA C/S
3 1/2
1/4 AL. TUBE BOLT OR RIVET TO C/S
PLY OR CARDBOARD REENFORCE GIVES WEIGHTED TIP EFFECTS
HINGE SECURED TO C/S WITH BOLTS
F. Zaic
VERTICAL FINS 1/16 x 1 x 1 3/4 BALSA
3
1/8 PLY
WATTEYNE VERTICAL STABILIZER
13" x 18 SWG BALANCE ARM INSERT IN END OF TUBE & CLINCH
HINGE TIN CAN STOCK
3/4
TONGUES PUSHED INTO BLADES & CEMENTED
20 SWG
45° SKEW
BUSH TO TAKE UP THRUST
WT. LEAD
BRASS TUBE BRG.
BEND WIRES TO OBTAIN 10° TO 15° POSITIVE ANGLE AT HUB
WASHER
WASH-OUT TIPS TO BE 5° LESS THAN AT HUB
VERY STABLE FLYER WITH GOOD AUTOROTATION
SILHOUETTE BODY 1/16 x 1 1/2 x 12
178
18 SWG WIRE FOR ROTOR AXIS CEMENTED TO FUSLG WITH PAPER STRIP REENFORCE.
TRIPOD BENT + SOLDERED TO BOT. OF ROTOR AXIS
"WASP" POWER BOOM ROTOR SYSTEM
F.G. BOREHAM — ENGLAND

MAGNUS EFFECT AND ROTATING WINGS

Bill Foshag of Washington, D.C. sent his Note Book on Rotating Wings and a copy of Royal Aircraft Establishment Tech. Note No. Aero. 2492 which dealt with rotating wings. Also received Rotating Wing plans from Bruno Horstenke, Germany, and Charles Chilvers, California.

Because Bill's book had more material in it than could be included in this Year Book, it was returned with request to condense portion of it, and to include plans of one of his models. Press of business made it impossible for Bill to comply with the request, and the following text is a review of Magnus Effect which can be found in most aeronautical text books.

The Lift developed by the Magnus Effect depends on the rotor's peripheral velocity and the relative air or wind velocity. When the peripheral velocity is high in relation to the wind, the Lift is relatively high. When the peripheral velocity is low in relation to the wind, the Lift is relatively low. The reason for this difference lies in the nature by which Lift is produced. If the peripheral velocity is same as wind, the movement of the Cylinder's diameter matches the air velocity on the upper portion, and no disturbance takes place. But on the lower portion, the two velocities are in direct apposition. The result is that the relative velocity is reduced in that region. With reduction in velocity there is a relative increase in air pressure which tends to move the Cylinder upward or perpendicular to the relative airflow. In case where the peripheral velocity of the Cylinder is greater than the wind's or relative airflow, the air in the neighborhood of the upper portion is accelerated to higher velocity, and the lower portion decelerated to lower values. The net effect is lower air pressure on top and greater pressure on bottom, resulting in an upward force acting on the Cylinder.



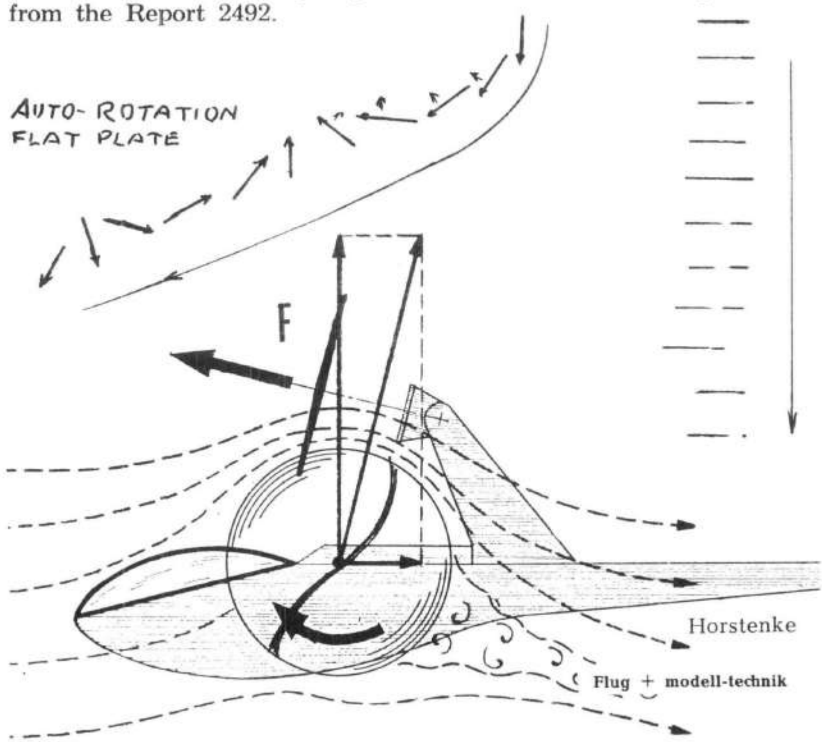
To obtain Magnus Effect, the cylinder must be rotated by auxiliary power. Similar results, however, can be obtained by changing the "cylinder" to a flat surface, pivoted on center of the span axis. When this surface is exposed to moving air, and given a slight rotation, it will tend to auto-rotate as long as it is acted upon by the moving air.

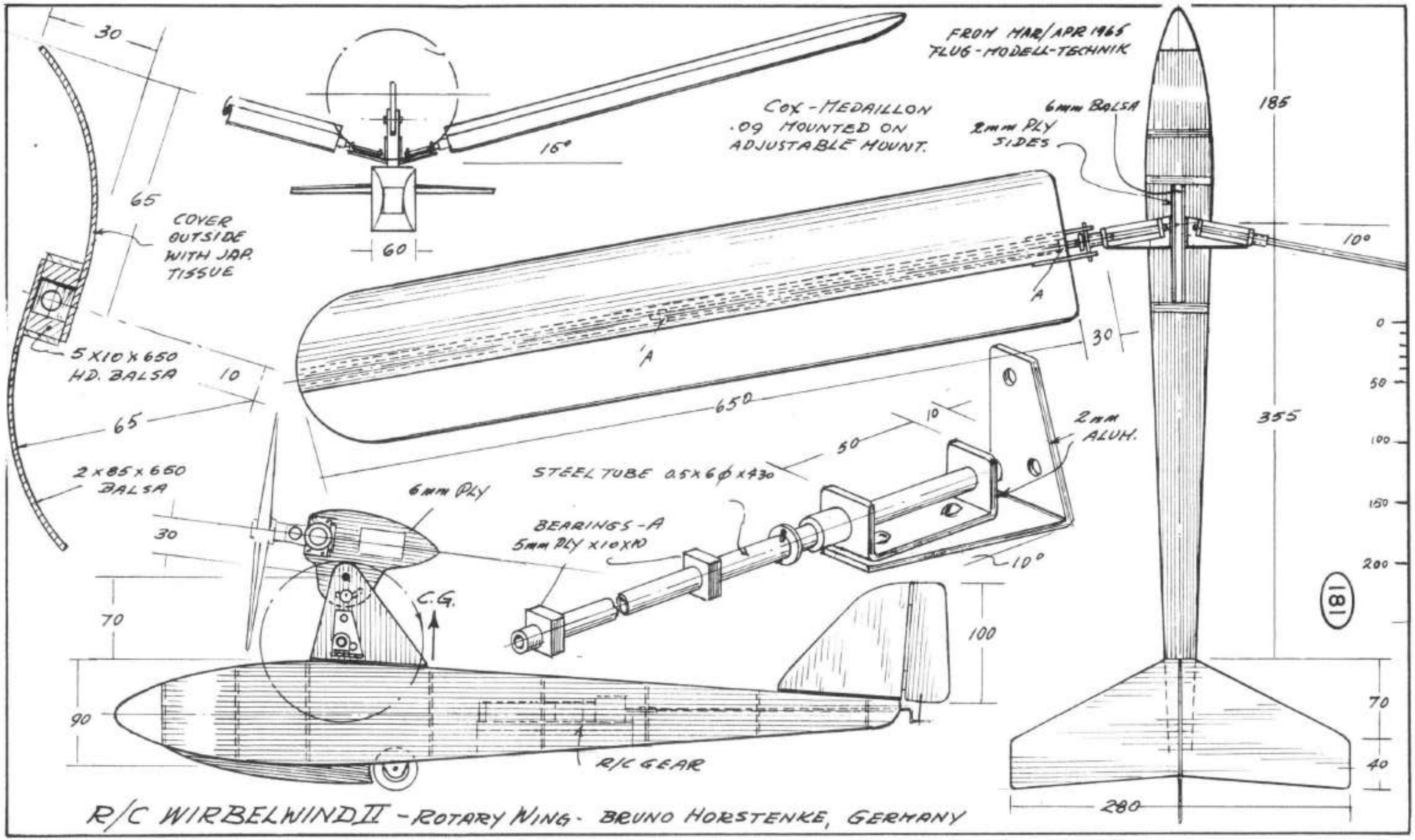
You can make the following simple test to demonstrate the "lifting" capabilities of auto-rotation. Take a 1/16 x 3 x 12 balsa sheet. Raise it overhead and drop it "flatwise". Count time it takes to reach the floor. Then take the same piece and drop it edgewise. Although it may start to drop faster, it will soon start to rotate and move away from you, and take almost twice as long to reach the floor as it did on the "flatwise" try. Obviously, the rotating sheet must be producing lift as it descended much slower than one which acted like a parachute.

This is no place to go into detailed explanation of auto-rotation except to mention that auto-rotation is caused by the movement of the Center of Pressure. Center of Pressure or Lift on an angled surface is near the Leading Edge at low angles, and it moves to center when the surface is at 90° to the airflow. Although one would think that the flat plate should balance at 90°, the initial momentum very likely causes it to continue rotating in the initial direction and thus overcoming the effect of Center of Lift acting against the rotation.

To help the "wing" to continue rotating and overcoming the effect of "Lift" acting against rotation as the wing moves beyond the 90° position, the edges are "gutted" which act in manner similar to airometer cups. The similarity can be carried to extreme by shaping the rotor wing into a double "S" form.

We now have, in effect, a rotating cylinder which is rotated by the wind or relative air flow. The Magnus Effect is generated by the edges as they approach the vertical positions. This is simplified explanation. Many questions are left unanswered. Perhaps in the next Year Book we will have a more detailed explanation. In the meantime, the above may help to understand the charts reproduced from the Report 2492.





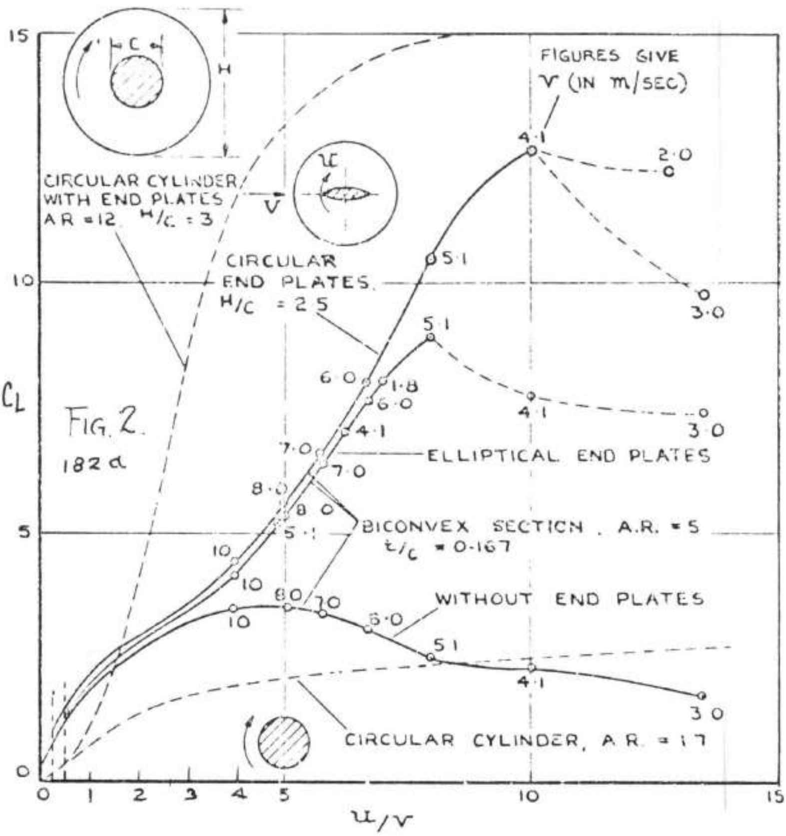
FROM MAR/APR 1965
FLUG-MODELL-TECHNIK
COX-MEDAILLON
.09 MOUNTED ON
ADJUSTABLE MOUNT.
6mm BALSA
2mm PLY
SIDES
COVER
OUTSIDE
WITH JAP.
TISSUE
5 X 10 X 650
HD. BALSA
2 X 85 X 650
BALSA
6mm PLY
STEEL TUBE 0.5 X 6 ϕ X 430
BEARINGS-A
5mm PLY X 10 X 10
2mm
ALUM.
C.G.
R/C GEAR
181
R/C WIRBELWIND II - ROTARY WING - BRUNO HORSTENKE, GERMANY

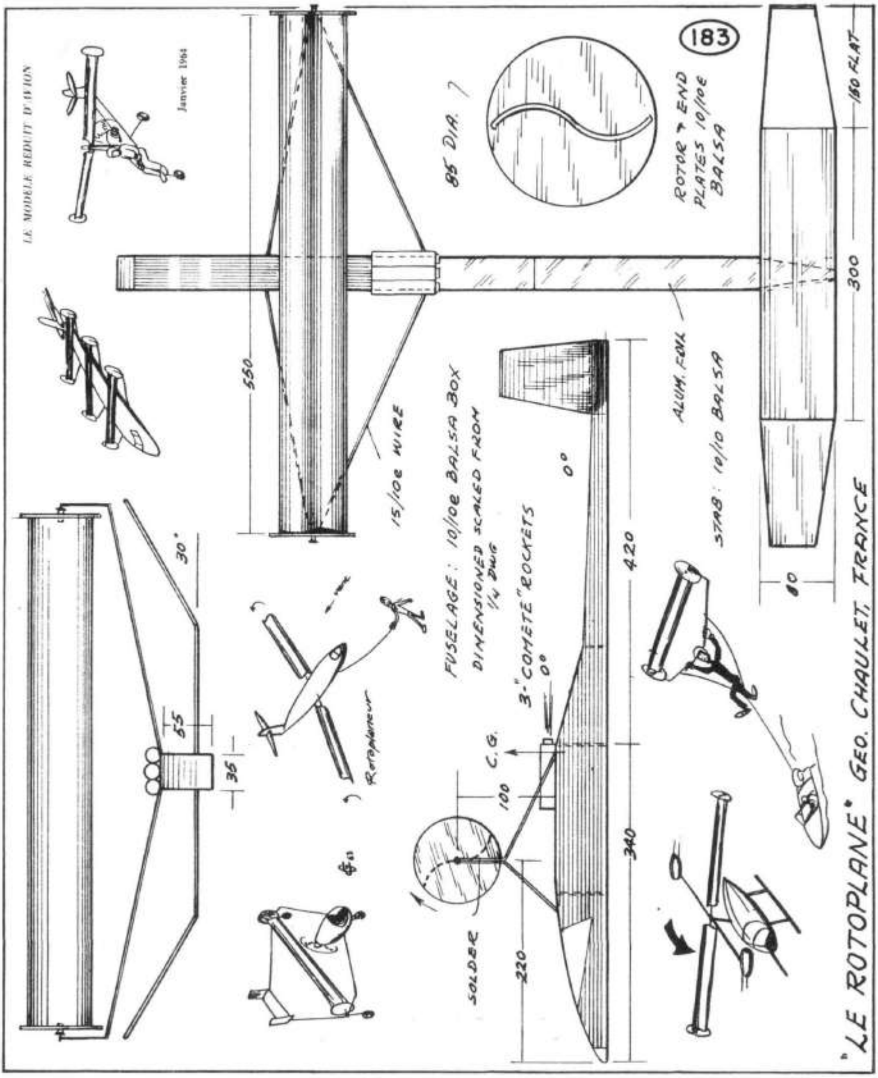
Fig. 1 shows the effect of air velocity on autorotation of Biconvex Circular Arc sections of various thickness, with and without end plates. "U" represents the peripheral velocity of the "wing edges". Assuming an air velocity of 10 m per sec. (33 ft./sec. or 23 mph) the wing with a Thickness/Chord ratio of 1/5, and using end plates, will have a peripheral velocity of 5 m (16.6 ft./sec.) Assuming a 4″ chord, this velocity will cause the wing to rotate at 960 R.P.M. At velocities lower than 10 m/sec., the values on the chart seem to run into the usual hazy values found at model speeds.

Fig. 2 is very interesting. It shows the potential high lift produced if the rotor-wing is rotated by auxiliary power to obtain higher peripheral velocity than that of the relative airflow. However, our interest is in the ¼ and ½ values of U/V which indicate the autorotation area. Values are again undetermined for our sphere of work.

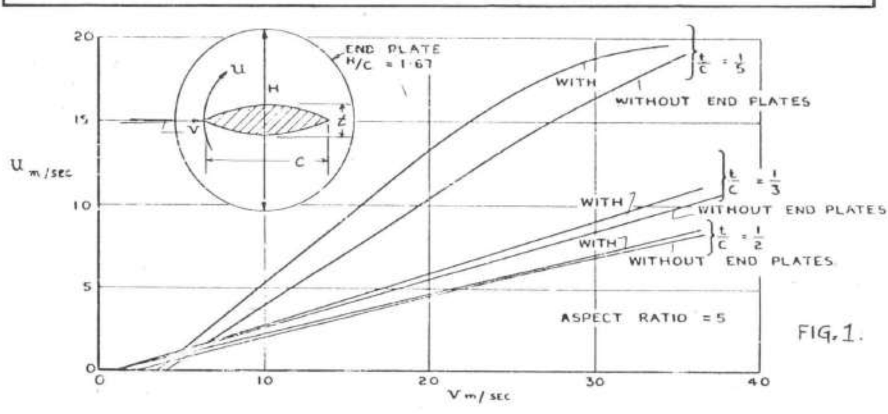
From these charts you can draw your own conclusion. Some of you may be interested in the subject to experiment. Let us know.

Recalling some of Bill Foshag recommendations: Use end plates, no sweep back, major construction problem being to secure free rotating of the wings without binding on the long axle. His collection of rotor-wing models consisted of gliders, kites and powered models. He lost some of them O.S. in thermals.



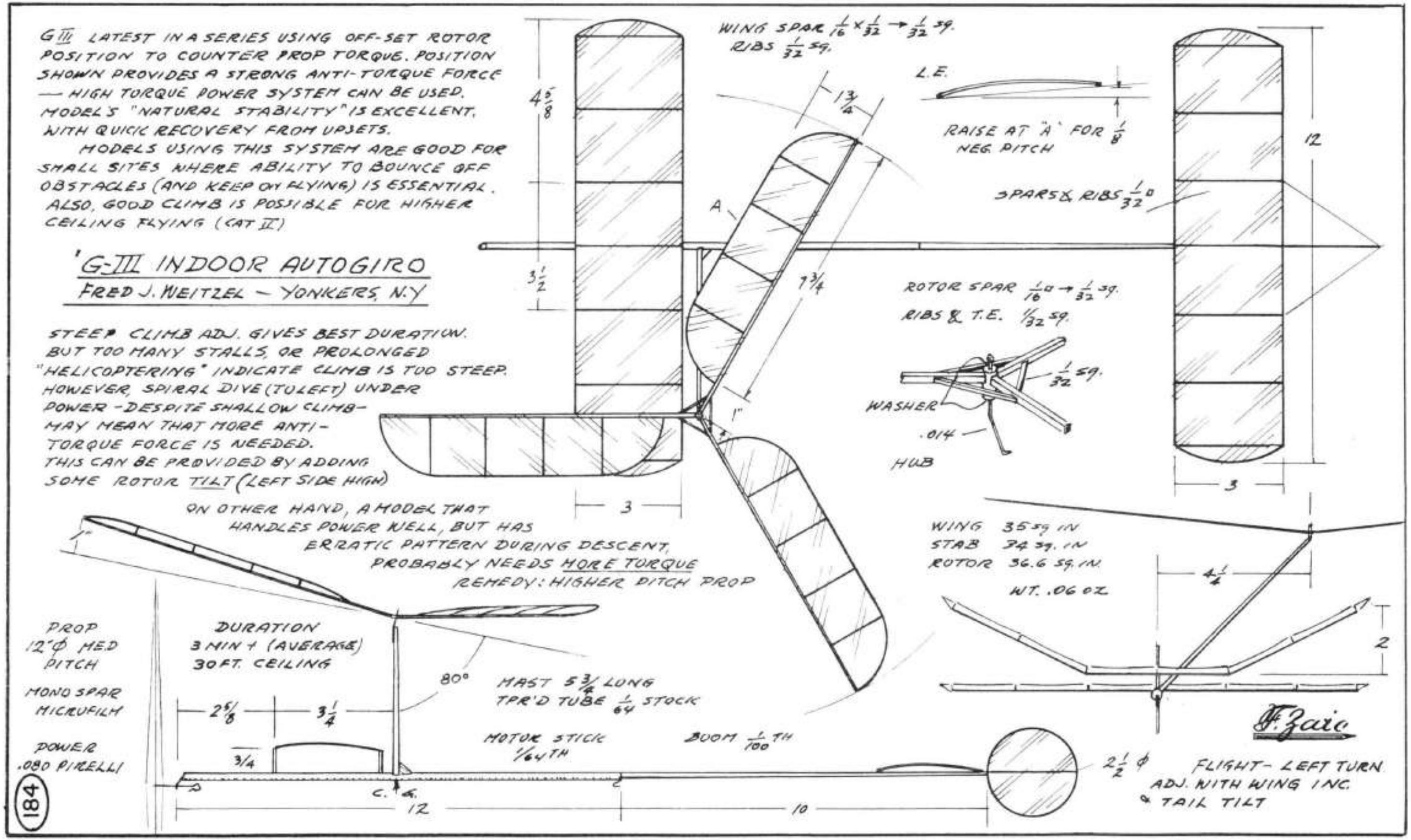


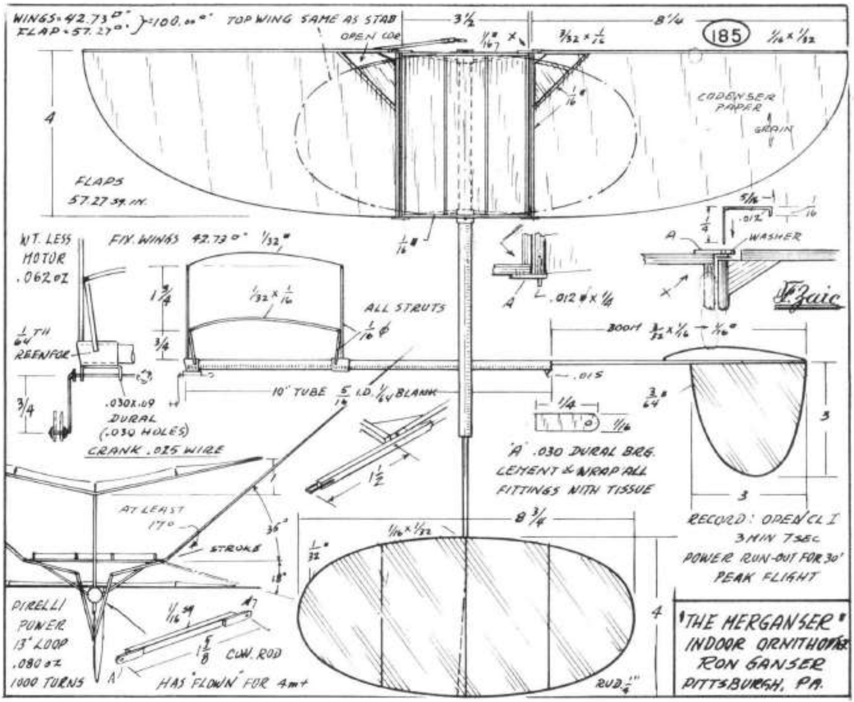
183
LE MODELE REDUIT D'AVION
Janvier 1964
85 DIA.
ROTOR + END PLATES 10/10E BALSA
180 FLAT
300
80
550
15/10E WIRE
FUSELAGE: 10/10E BALSA BOX
DIMENSIONED SCALED FROM 1/4 DWG
3" "COMETE" ROCKETS
0°
0°
ALUM. FOIL
STAB: 10/10 BALSA
420
340
220
100
C.G.
SOLDER
30°
55
35
Rotoplaneur
"LE ROTOPLANE" GEO. CHAULET, FRANCE

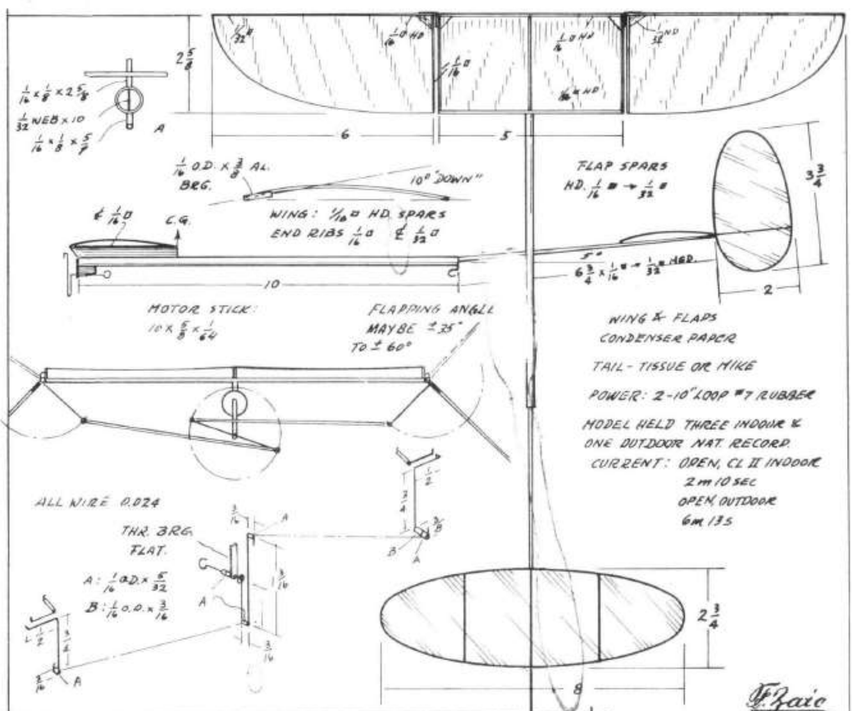


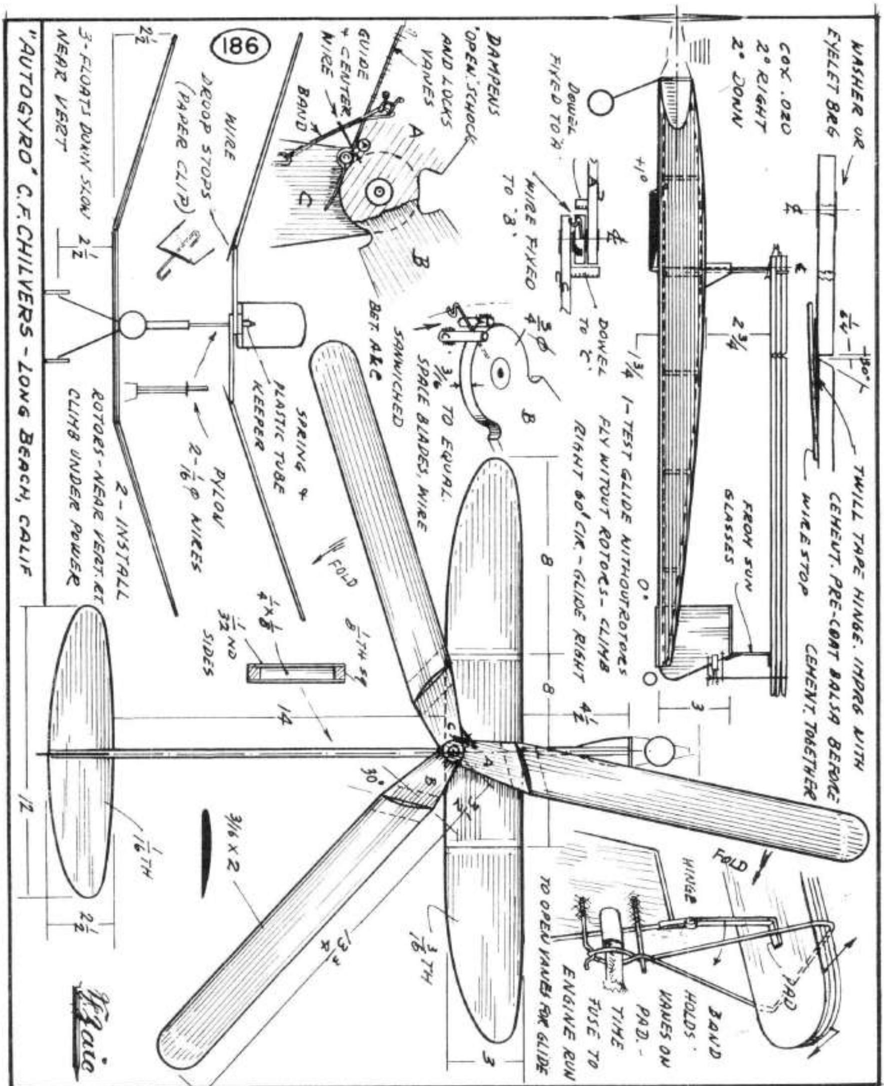
END PLATE
H/C = 1·67
U
H
V
t
C
U m/sec
V m/sec
0
5
10
15
20
0
10
20
30
40
WITH
WITHOUT END PLATES
t/c = 1/5
t/c = 1/3
t/c = 1/2
ASPECT RATIO = 5

FIG. 1.


GIII LATEST IN A SERIES USING OFF-SET ROTOR POSITION TO COUNTER PROP TORQUE. POSITION SHOWN PROVIDES A STRONG ANTI-TORQUE FORCE — HIGH TORQUE POWER SYSTEM CAN BE USED. MODEL'S "NATURAL STABILITY" IS EXCELLENT, WITH QUICK RECOVERY FROM UPSETS.
MODELS USING THIS SYSTEM ARE GOOD FOR SMALL SITES WHERE ABILITY TO BOUNCE OFF OBSTACLES (AND KEEP ON FLYING) IS ESSENTIAL. ALSO, GOOD CLIMB IS POSSIBLE FOR HIGHER CEILING FLYING (CAT II)
G-III INDOOR AUTOGIRO
FRED J. WEITZEL — YONKERS, N.Y.
STEEP CLIMB ADJ. GIVES BEST DURATION. BUT TOO MANY STALLS, OR PROLONGED "HELICOPTERING" INDICATE CLIMB IS TOO STEEP. HOWEVER, SPIRAL DIVE (TO LEFT) UNDER POWER - DESPITE SHALLOW CLIMB - MAY MEAN THAT MORE ANTI-TORQUE FORCE IS NEEDED. THIS CAN BE PROVIDED BY ADDING SOME ROTOR TILT (LEFT SIDE HIGH)
ON OTHER HAND, A MODEL THAT HANDLES POWER WELL, BUT HAS ERRATIC PATTERN DURING DESCENT, PROBABLY NEEDS MORE TORQUE
REMEDY: HIGHER PITCH PROP
WING SPAR 1/16 × 1/32 → 1/32 SQ.
RIBS 1/32 SQ.
L.E.
RAISE AT "A" FOR 1/8 NEG. PITCH
SPARS & RIBS 1/32 □
A
4 5/8
3 1/2
3
1 3/4
7 3/4
1"
12
ROTOR SPAR 1/16 □ → 1/32 SQ.
RIBS & T.E. 1/32 SQ.
1/32 SQ.
WASHER
.014
HUB
WING 35 SQ IN
STAB 34 SQ. IN
ROTOR 36.6 SQ. IN.
WT. .06 OZ.
4 1/4
2
1"
80°
PROP 12"Ø MED PITCH
MONO SPAR MICROFILM
POWER .080 PIRELLI
DURATION 3 MIN + (AVERAGE) 30 FT. CEILING
MAST 5 3/4 LONG TPR'D TUBE 1/64 STOCK
MOTOR STICK 1/64 TH
BOOM 1/100 TH
2 5/8
3 1/4
3/4
C.G.
12
10
2 1/2 Ø
FLIGHT - LEFT TURN ADJ. WITH WING INC. & TAIL TILT
F. Zaic
184


WINGS = 42.73 □" FLAP = 57.27 □" } = 100.00 □"
TOP WING SAME AS STAB
OPEN COR
185
CONDENSER PAPER
GRAIN
FLAPS 57.27 SQ. IN.
WT. LESS MOTOR .062 OZ
FIX. WINGS 42.73 □"
ALL STRUTS
WASHER
BOOM
10" TUBE
.030 X .09 DURAL (.030 HOLES)
CRANK .025 WIRE
"A" .030 DURAL BRG.
CEMENT & WRAP ALL FITTINGS WITH TISSUE
AT LEAST 17°
STROKE
RECORD: OPEN CL I 3 MIN 7 SEC
POWER RUN-OUT FOR 30" PEAK FLIGHT
PIRELLI POWER 13" LOOP .080 OZ 1000 TURNS
CON. ROD
HAS "FLOWN" FOR 4m+
"THE MERGANSER" INDOOR ORNITHOPTER
RON GANSER
PITTSBURGH, PA.
F. Zaic


BRG.
10° "DOWN"
WING: 1/16 □ HD SPARS
END RIBS
FLAP SPARS
C.G.
MOTOR STICK:
FLAPPING ANGLE MAYBE ± 35° TO ± 60°
WING & FLAPS CONDENSER PAPER
TAIL - TISSUE OR MIKE
POWER: 2-10" LOOP #7 RUBBER
MODEL HELD THREE INDOOR & ONE OUTDOOR NAT. RECORD.
CURRENT: OPEN, CL II INDOOR 2 m 10 SEC
OPEN, OUTDOOR 6m 13 S
ALL WIRE 0.024
THR. BRG. FLAT.
F. Zaic
"ILL EAGLE" ORNITHOPTER - JERALD B. MURPHY - DALLAS TEX.

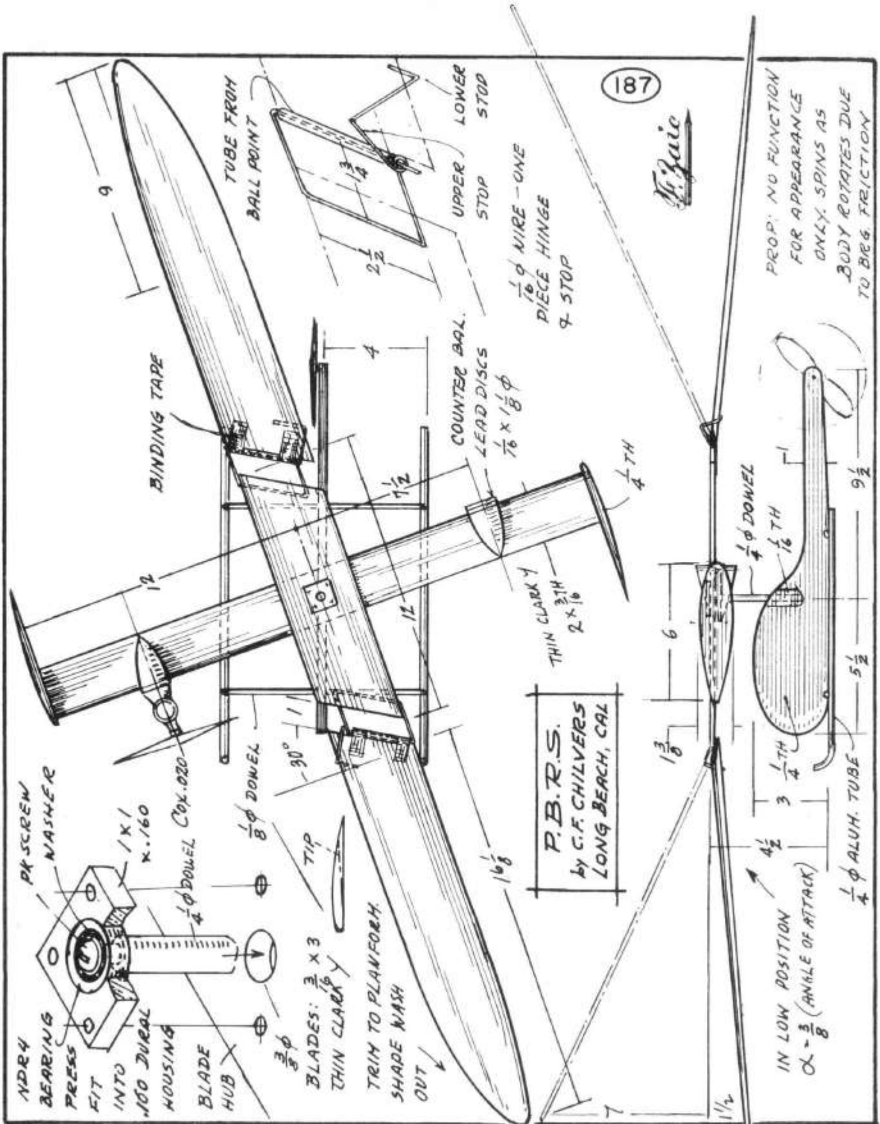


DESIGN PHILOSOPHY

Charles Chilvers — Long Beach, Calif.

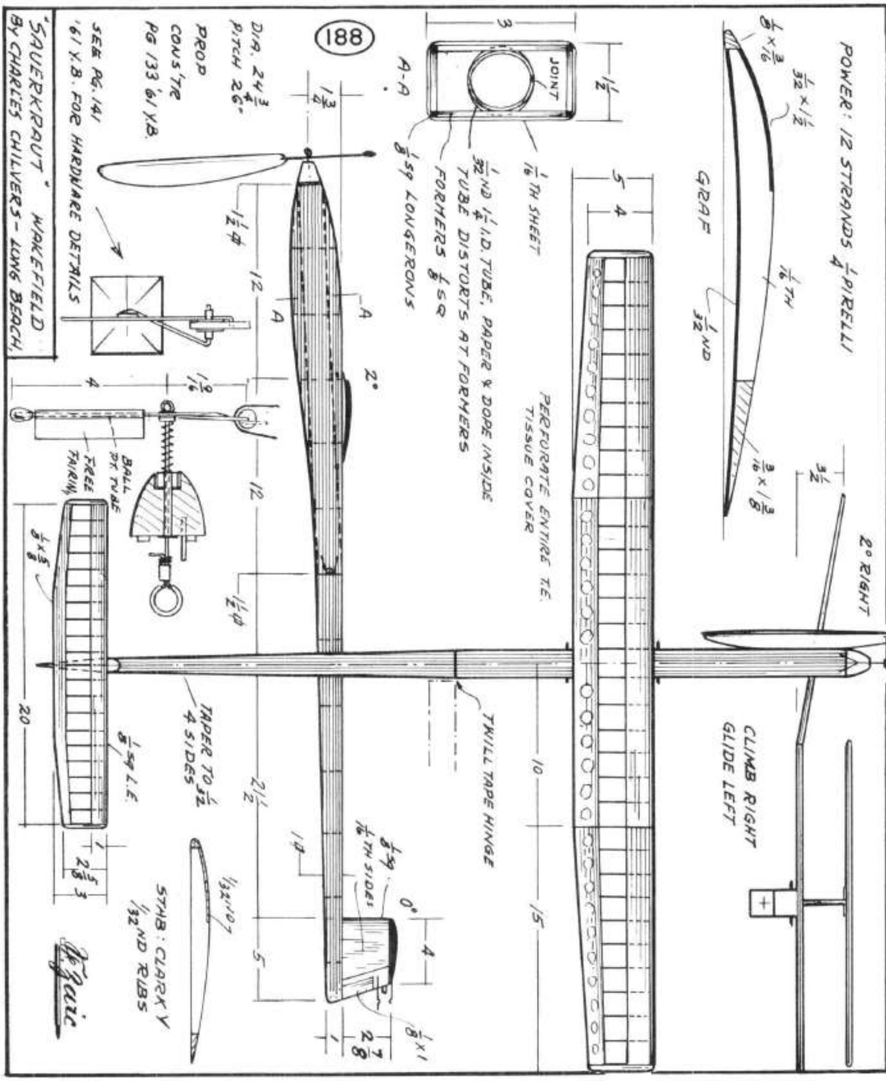
Re: Your letter on Building Philosophy.

My building of Model Aircraft dates back to 1927. The Long Beach Recreation Commission offered clasess in model building. The instructor, Louis McCready, had about 19 interested youngsters in his classes. The first models were small all balsa gliders. In those days the cements we used were "Ambroid" and "Glen Elmo." The first rubber powered models were R.O.G.s, Flying Scale Kits came next. It did not take long to realize which designs to stay away from.



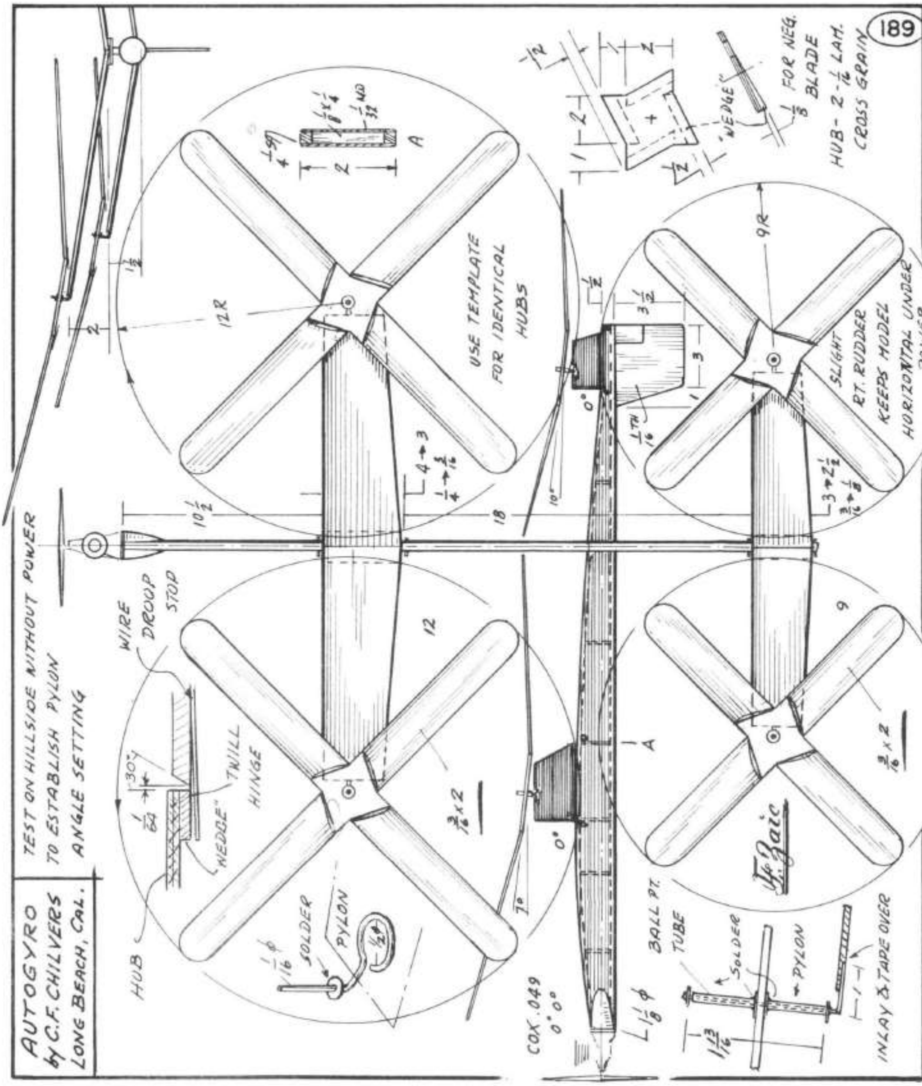
Bill Atwood, in the early '30s taugh modeling. He always stressed simplicity in design. At one of our contests I had a model built from magazine plans. I built it as shown. Atwood helped me wind it and upon launching it— it was out of adjustment. I tried to change the stab incidence and it was not designed properly. Bill said, "This model cannot keep its adjustments." This was like being hit by a bolt of lightning! He let me have my model like a "Hot Potato." From then on, you can rest assured, my models were designed to STAY adjusted.

Thru the Thirties model building was like a "golden era" for us. We used your Year Books for every idea under the sun to improve our designs. The simple designs paid off in cost and time.



Model building had to be shelved for quite a spell and now with my youngsters getting big enough to build and fly, we started to try new (and old) designs.

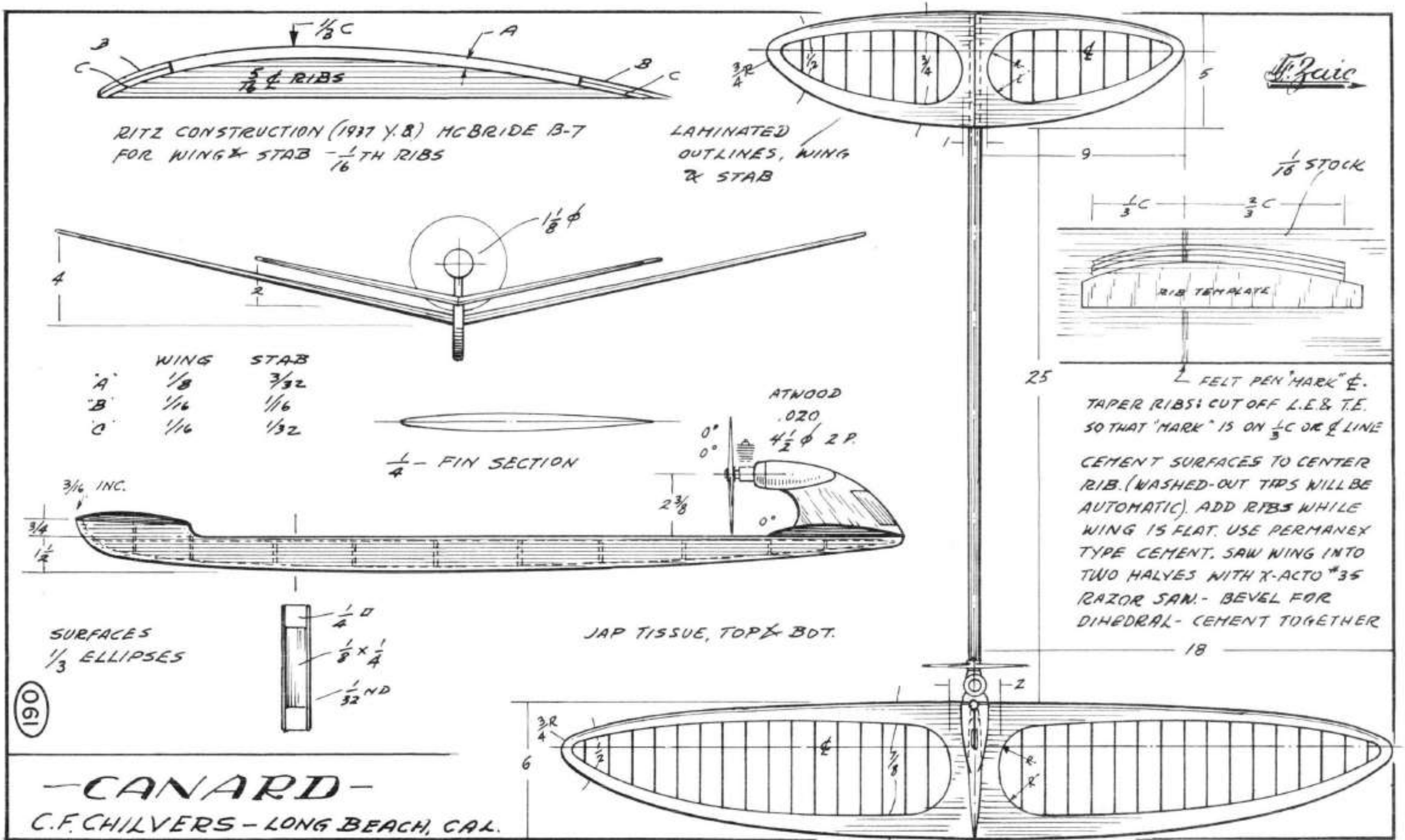
The housing boom here has left us one small flying field; where we used to have acres. Being a free flight enthusiast the models we build, by necessity, must be rugged and have limited capability as far as duration goes, even using de-thermalizers. The all-balsa approach is a natural and also the best for easy repairs. As you so well know — if we were to fly in the middle of the "Sahara Desert" and there was ONE stick standing up, the model would hit it.



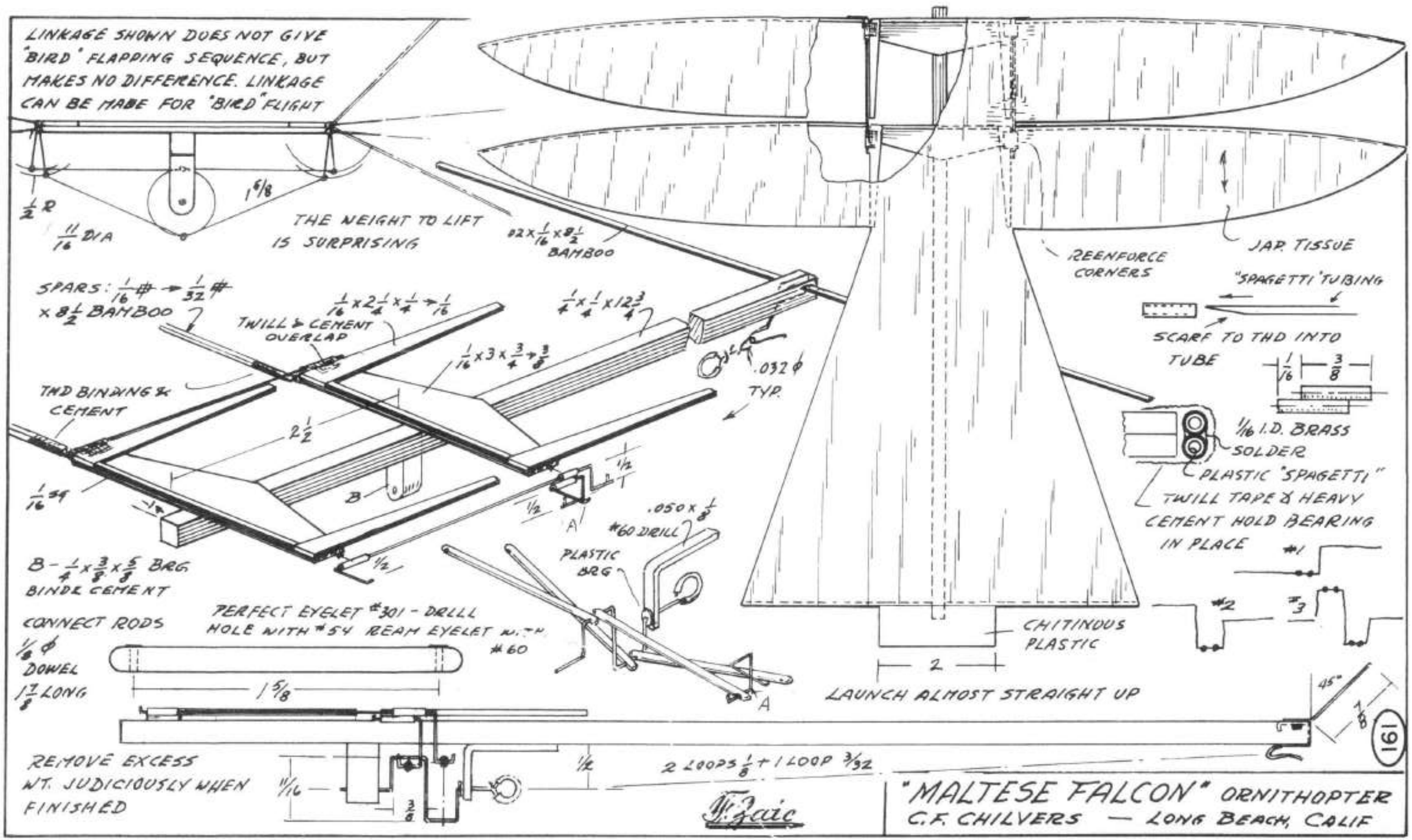
Experimental designs are a challenge with the various lifting devices employed. The efficiency of the models could be greatly increased by using built-up constructioin, but to get good performance (we have lost them in thermals) from all-balsa models is a real thrill.

The models use anything that can be adapted for a specific purpose. Necessity is the mother of invention. Have boxes of gimmicks and gadgets that may be modified to serve a purpose.

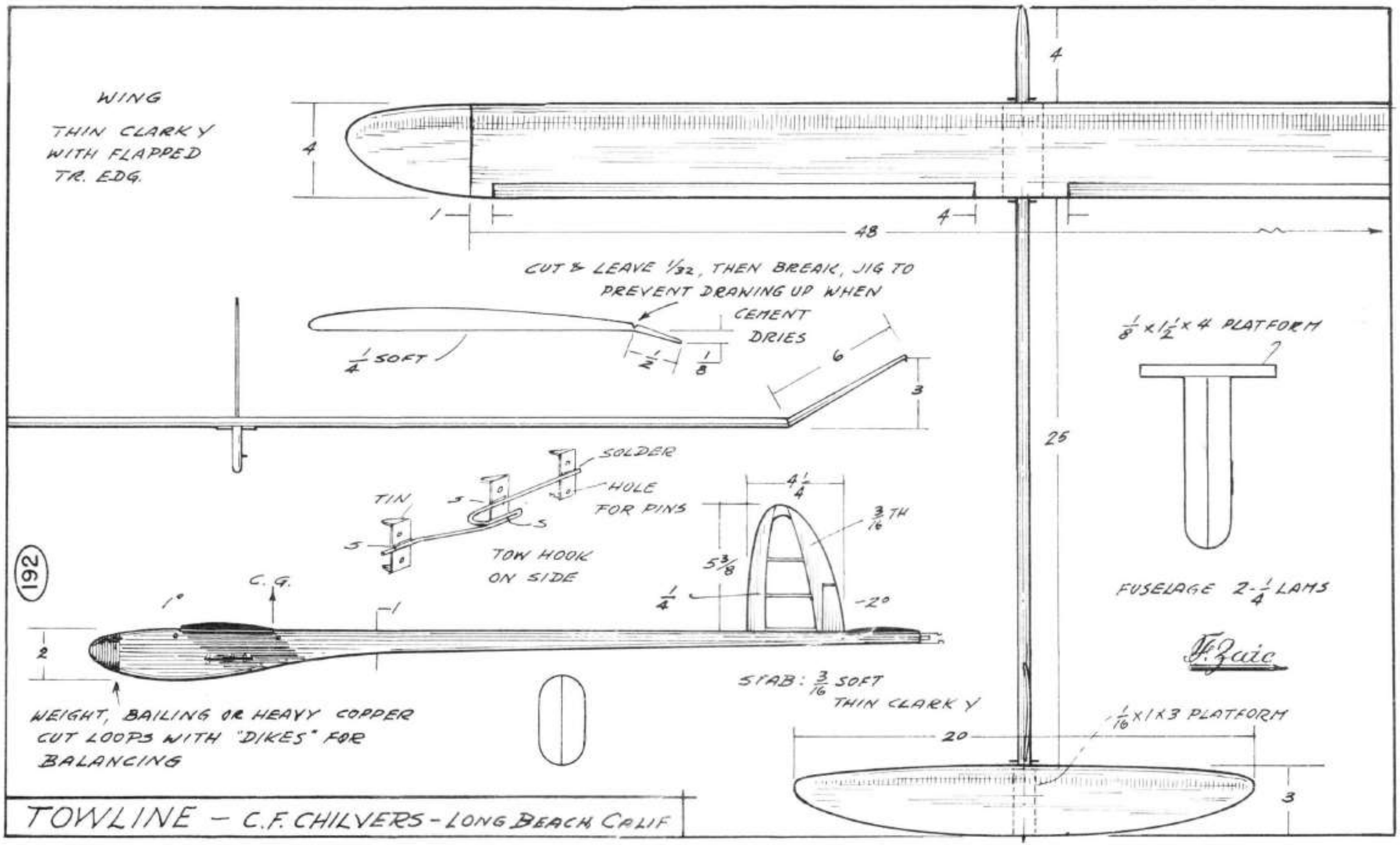
The rule to remember is: "SIMPLICITY OF DESIGN." It is our most important design policy. Inherently the design requirements of space vehicles and our new aircraft tend toward complex designs, but the simplest designs possible, to do the job, pay off in all ways.

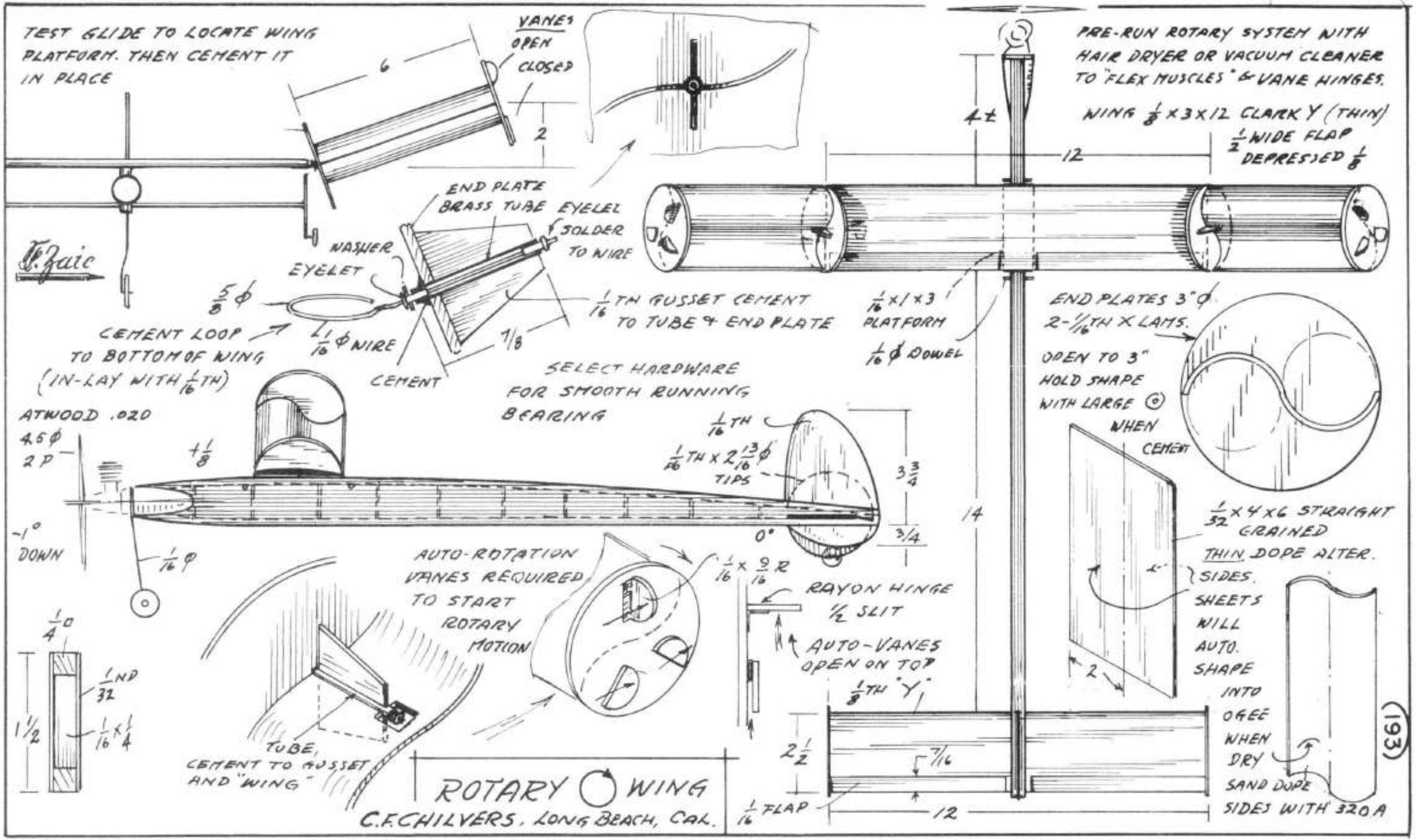


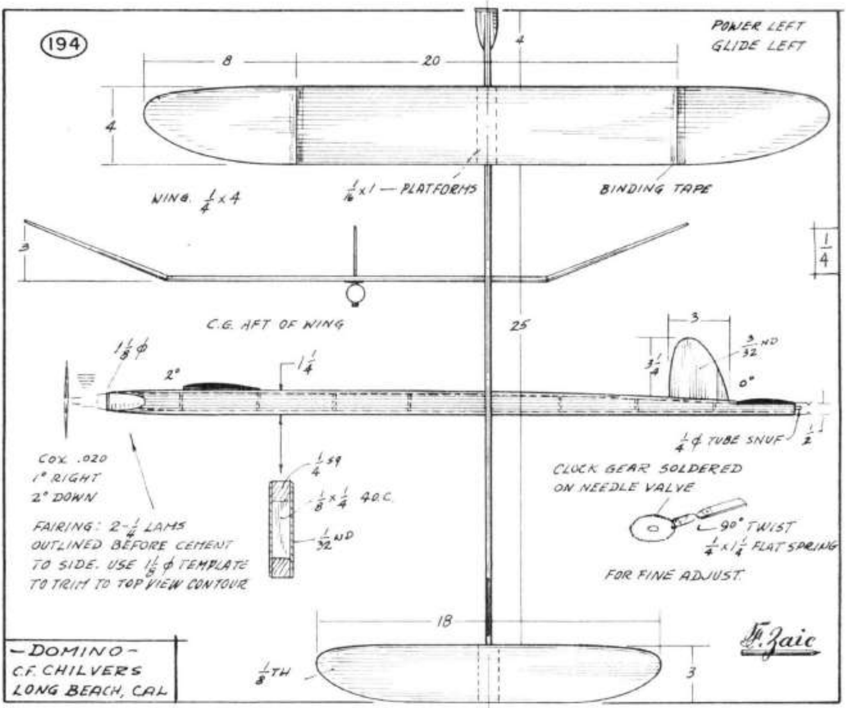
1/3 C
A
B
C
5/16 ¢ RIBS
RITZ CONSTRUCTION (1937 Y.B.) MCBRIDE B-7
FOR WING & STAB - 1/16 TH RIBS
LAMINATED OUTLINES, WING & STAB
1 1/8 φ
4
2
WING STAB
"A" 1/8 3/32
"B" 1/16 1/16
"C" 1/16 1/32
1/4 - FIN SECTION
ATWOOD .020
4 1/2 φ 2 P.
0°
0°
2 3/8
3/16 INC.
3/4
1 1/2
SURFACES 1/3 ELLIPSES
1/4 □
1/8 × 1/4
1/32 ND
JAP TISSUE, TOP & BOT.
3/4 R
1/2
3/4
5
9
1
1/16 STOCK
1/3 C
2/3 C
RIB TEMPLATE
25
FELT PEN "MARK" ¢.
TAPER RIBS: CUT OFF L.E. & T.E. SO THAT "MARK" IS ON 1/3 C OR ¢ LINE
CEMENT SURFACES TO CENTER RIB. (WASHED-OUT TIPS WILL BE AUTOMATIC). ADD RIBS WHILE WING IS FLAT. USE PERMANEX TYPE CEMENT. SAW WING INTO TWO HALVES WITH X-ACTO #35 RAZOR SAW.- BEVEL FOR DIHEDRAL- CEMENT TOGETHER
18
2
6
7/8
190
-CANARD-
C.F. CHILVERS - LONG BEACH, CAL.

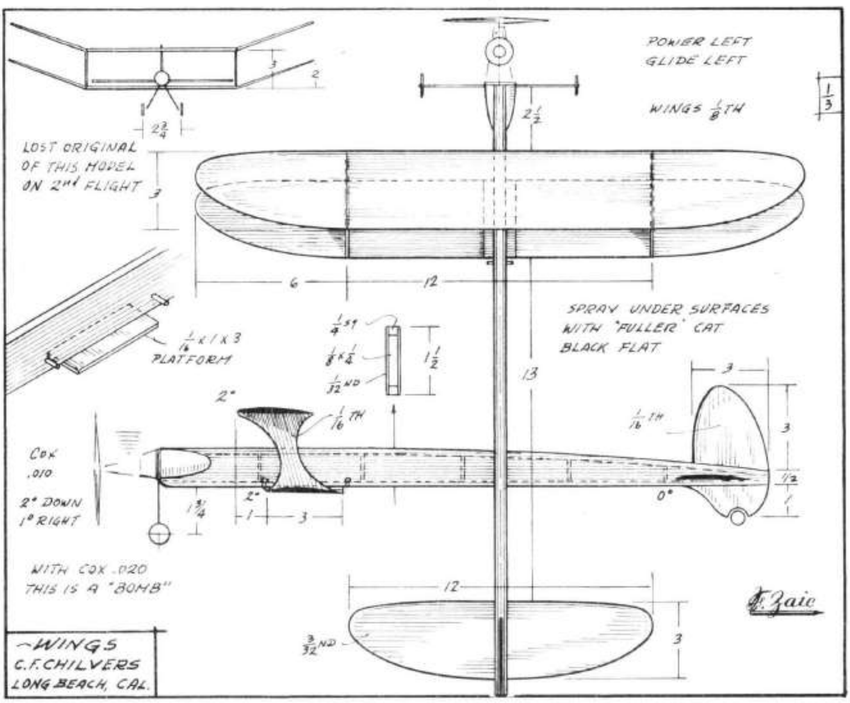


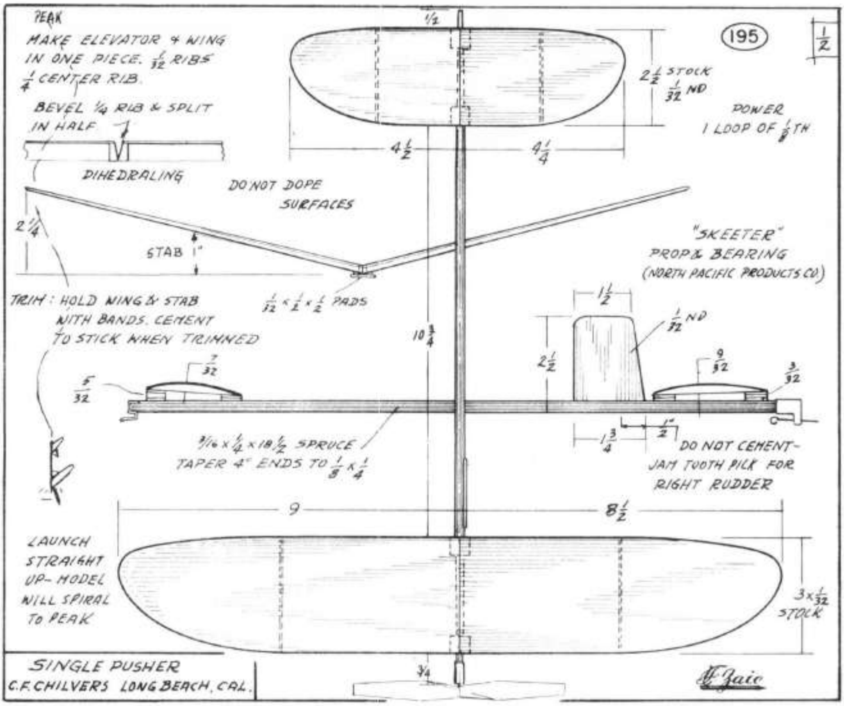
LINKAGE SHOWN DOES NOT GIVE "BIRD" FLAPPING SEQUENCE, BUT MAKES NO DIFFERENCE. LINKAGE CAN BE MABE FOR "BIRD" FLIGHT
1/2 R
11/16 DIA
1 5/8
THE NEIGHT TO LIFT IS SURPRISING
.02 X 1/16 X 8 1/2 BAMBOO
SPARS: 1/16 # → 1/32 # X 8 1/2 BAMBOO
1/16 X 2 1/4 X 1/4 → 1/16
TWILL & CEMENT OVERLAP
1/4 X 1/4 X 12 3/4
1/16 X 3 X 3/4 → 3/8
.032 ϕ
TYP.
THD BINDING & CEMENT
2 1/2
1/16 SQ
B
1/2
A
.050 X 1/8
#60 DRILL
PLASTIC BRG
B - 1/4 X 3/8 X 5/8 BRG BIND & CEMENT
PERFECT EYELET #301 - DRLLL HOLE WITH #54 REAM EYELET WITH #60
CONNECT RODS
1/8 ϕ DOWEL
1 7/8 LONG
1 5/8
A
REENFORCE CORNERS
JAP. TISSUE
"SPAGETTI" TUBING
SCARF TO THD INTO TUBE
1/16
3/8
1/16 I.D. BRASS
SOLDER
PLASTIC "SPAGETTI"
TWILL TAPE & HEAVY CEMENT HOLD BEARING IN PLACE
#1
#2
#3
CHITINOUS PLASTIC
2
LAUNCH ALMOST STRAIGHT UP
45°
7/8
191
REMOVE EXCESS WT. JUDICIOUSLY WHEN FINISHED
11/16
3/8
1/2
2 LOOPS 1/8 + 1 LOOP 3/32
W. Zaic
"MALTESE FALCON" ORNITHOPTER
C.F. CHILVERS — LONG BEACH, CALIF

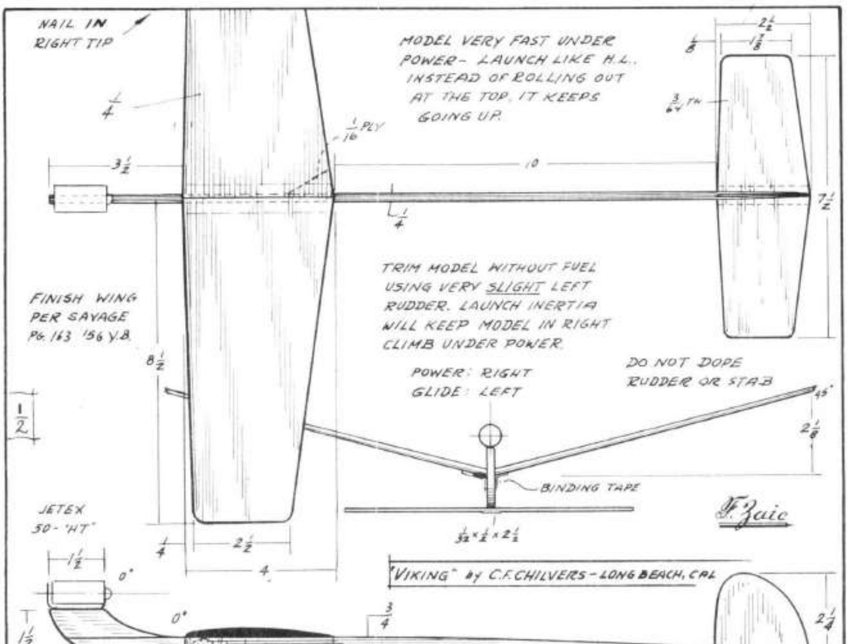

WING
THIN CLARK Y WITH FLAPPED TR. EDG.
4
1
4
48
CUT & LEAVE 1/32, THEN BREAK, JIG TO PREVENT DRAWING UP WHEN CEMENT DRIES
1/4 SOFT
1/2
1/8
6
3
25
1/8 x 1 1/2 x 4 PLATFORM
SOLDER
HOLE FOR PINS
TIN
S
TOW HOOK ON SIDE
4 1/4
3/16 TH
5 3/8
1/4
-2°
C. G.
1°
1
2
FUSELAGE 2-1/4 LAMS
F. Zaic
WEIGHT, BAILING OR HEAVY COPPER CUT LOOPS WITH "DIKES" FOR BALANCING
STAB: 3/16 SOFT THIN CLARK Y
1/16 x 1 x 3 PLATFORM
20
3
192
TOWLINE – C.F. CHILVERS – LONG BEACH CALIF


TEST GLIDE TO LOCATE WING PLATFORM. THEN CEMENT IT IN PLACE
VANES
OPEN
CLOSED
6
2
END PLATE
BRASS TUBE
EYELET
SOLDER TO WIRE
WASHER
EYELET
5/8 ⌀
1/16 ⌀ WIRE
CEMENT LOOP TO BOTTOM OF WING (IN-LAY WITH 1/16 TH)
CEMENT
1/16 TH GUSSET CEMENT TO TUBE & END PLATE
7/8
SELECT HARDWARE FOR SMOOTH RUNNING BEARING
ATWOOD .020
4.5 ⌀
2 P
+1/8
-1°
DOWN
1/16 ⌀
1/16 TH
1/16 TH x 2 13/16 ⌀ TIPS
0°
3 3/4
3/4
AUTO-ROTATION VANES REQUIRED TO START ROTARY MOTION
1/16 x 9/16 R
RAYON HINGE
1/2 SLIT
AUTO-VANES OPEN ON TOP
1/4 □
1/32 ND
1 1/2
1/16 x 1/4
TUBE, CEMENT TO GUSSET AND "WING"
ROTARY WING
C.F. CHILVERS, LONG BEACH, CAL.
PRE-RUN ROTARY SYSTEM WITH HAIR DRYER OR VACUUM CLEANER TO "FLEX MUSCLES" & VANE HINGES.
WING 1/8 x 3 x 12 CLARK Y (THIN)
1/2 WIDE FLAP DEPRESSED 1/8
4 1/2
12
1/16 x 1 x 3 PLATFORM
1/16 ⌀ DOWEL
END PLATES 3" ⌀
2-1/16 TH x LAMS.
OPEN TO 3" HOLD SHAPE WITH LARGE © WHEN CEMENT
14
1/32 x 4 x 6 STRAIGHT GRAINED
THIN DOPE ALTER. SIDES. SHEETS WILL AUTO. SHAPE INTO OGEE WHEN DRY
SAND DOPE SIDES WITH 320 A
2
1/8 TH "Y"
2 1/2
7/16
1/16 FLAP
12
F. Zaic


194
POWER LEFT
GLIDE LEFT
8
20
4
4
1/16 x 1 — PLATFORMS
BINDING TAPE
WING. 1/4 x 4
1/4
3
C.G. AFT OF WING
25
$1\frac{1}{8}\phi$
2°
$1\frac{1}{4}$
3
$3\frac{1}{4}$
3/32 WD
0°
1/4 φ TUBE SNUF
1/2
COX .020
1° RIGHT
2° DOWN
1/4 sq
1/8 x 1/4 4 O.C.
1/32 WD
CLOCK GEAR SOLDERED
ON NEEDLE VALVE
90° TWIST
$\frac{1}{4} \times 1\frac{1}{4}$ FLAT SPRING
FOR FINE ADJUST
FAIRING: 2 - 1/4 LAMS
OUTLINED BEFORE CEMENT
TO SIDE. USE $1\frac{1}{8}\phi$ TEMPLATE
TO TRIM TO TOP VIEW CONTOUR
18
1/8 TH
3
F. Zaic
— DOMINO —
C.F. CHILVERS
LONG BEACH, CAL


POWER LEFT
GLIDE LEFT
1/3
3
2
$2\frac{3}{4}$
$2\frac{1}{2}$
WINGS 1/8 TH
LOST ORIGINAL
OF THIS MODEL
ON 2nd FLIGHT
3
6
12
1/16 x 1 x 3
PLATFORM
1/4 sq
1/8 x 1/4
1/32 WD
$1\frac{1}{2}$
SPRAY UNDER SURFACES
WITH "FULLER" CAT.
BLACK FLAT
13
3
2°
1/16 TH
1/16 TH
3
1/2
1
COX
.010
2° DOWN
1° RIGHT
2°
$1\frac{3}{4}$
1
3
0°
WITH COX .020
THIS IS A "BOMB"
12
3/32 WD
3
F. Zaic
— WINGS
C.F. CHILVERS
LONG BEACH, CAL.


PEAK
MAKE ELEVATOR & WING IN ONE PIECE. 1/32 RIBS 1/4 CENTER RIB.
BEVEL 1/4 RIB & SPLIT IN HALF
DIHEDRALING
DO NOT DOPE SURFACES
195
1/2
2 1/2 STOCK 1/32 ND
POWER 1 LOOP OF 1/8 TH
4 1/2
4 1/4
2 1/4
STAB 1"
"SKEETER" PROP & BEARING (NORTH PACIFIC PRODUCTS CO.)
TRIM: HOLD WING & STAB WITH BANDS. CEMENT TO STICK WHEN TRIMMED
1/32 × 1/2 × 1/2 PADS
10 3/4
1 1/2
1/32 ND
2 1/2
7/32
5/32
9/32
3/32
3/16 × 1/4 × 18 1/2 SPRUCE TAPER 4" ENDS TO 1/8 × 1/4
1 3/4
1/2"
DO NOT CEMENT- JAM TOOTH PICK FOR RIGHT RUDDER
9
8 1/2
LAUNCH STRAIGHT UP- MODEL WILL SPIRAL TO PEAK
3 × 1/32 STOCK
SINGLE PUSHER
C.F. CHILVERS LONG BEACH, CAL.
3/4
F. Zaic


NAIL IN RIGHT TIP
MODEL VERY FAST UNDER POWER- LAUNCH LIKE H.L. INSTEAD OF ROLLING OUT AT THE TOP, IT KEEPS GOING UP.
2 1/2
1 7/8
1/8
3/64 TH
1/4
1/16 PLY
3 1/2
10
7 1/2
1/4
TRIM MODEL WITHOUT FUEL USING VERY SLIGHT LEFT RUDDER. LAUNCH INERTIA WILL KEEP MODEL IN RIGHT CLIMB UNDER POWER.
FINISH WING PER SAVAGE PG. 163 '56 Y.B.
8 1/2
POWER: RIGHT
GLIDE: LEFT
DO NOT DOPE RUDDER OR STAB
1/2
45°
2 1/8
BINDING TAPE
JETEX 50- "HT"
F. Zaic
1/32 × 1/2 × 2 1/2
1/4
2 1/2
4
1 1/2
0°
"VIKING" by C.F. CHILVERS - LONG BEACH, CAL
0°
3/4
1 1/2
2 1/4
EMERY 2 PCS
+1/64

ELECTRONICS THERMAL DETECTION

Roger Schroeder Overland Park, Kans.

A Thermal flight is necessary for winning contests and placing on international teams. What is a thermal and how can one determine when one is present ? A paper entitled "The Soaring Flight of Birds" by Clarence D. Cone Jr. best describes a thermal and its characteristics. This paper can be found in the April, 1962, issue of the Scientific American or the March, 1962, issue of the American Scientist, and should be read by all serious contest fliers.

Thermals are hard to detect before a flight. After a plane is airborne it is easy to tell if a thermal or a downdraft is present, but by then it's too late to do anything about it. One had best determine if a thermal is present before the plane is flown.

Since thermals are a mass of warm air their presence may be detected by a device that will measure slight changes in air temperature. A thermistor will measure very small temperature changes and is the sensing element used in most thermal detectors.

My first detector was assembled in the Fall of 1960. It consisted of a small bead type thermisor mounted on an auto antenna, connected to a loose jumble of wires, resistors and batteries. It predicted a few good thermals at a local meet and looked promising.

Since the unit was sensitive to wind velocity as well as temperature, the following years I put the thermistor in an encloseru designed to shield it from the wind, and mounted the electronic parts and the meter in a suitable box. The newly designed enclosure protected the thermistor from the wind, however, it also shielded the thermistor from the suitable temperature changes that indicated thermals.

For the 1962 season I revised the electrical circuit to reduce the sensitivity to wind velocity and opened the thermistor enclosure so that it was nothing more than a sunshade. Now the device would reliably indicate thermals.

At the 1962 Central FAI Finals I was able to find thermals for Dave Kneeland with approximately 80% accuracy. Dave's model did not need thermals to win but he was kind enough to let me get the practice.

Only one small circuit change to increase sensitivity has been made since 1962. The circuit is stable, can be compensated over a wide temperature range, and has a very low battery drain.

The circuit for my thermal detector is shown on the drawing. The thermistor is one leg of a Wheatstone bridge. Two legs of the bridge are fixed transistors and the fourth leg is a potentiometer used to compensate for the ambient temperature. The Wheatstone bridge is operated by a $1\frac{1}{2}$ V. battery. The output of the Wheatstone bridge is fed into a transistor amplifier circuit. The output of the amplifier circuit is connected to a 200 micro-ampere meter.

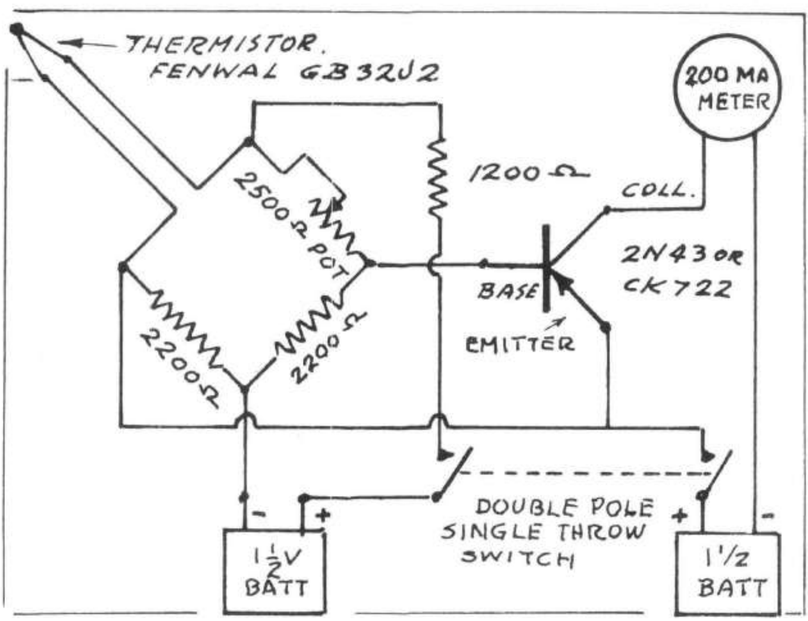
Any current flow through a thermistor will heat the thermistor causing a change in its resistance. If air is allowed to blow across the heated thermistor it will be cooled and the thermistor resistance will change. This is the self heating effect of thermistors and the reason that thermal detectors tend to be sensitive to wind velocity as well as to temperature.

In order to keep the wind velocity effect to a minimum, the current through a thermistor must be kept to a very small value. By using a transistor amplifier, the current in the Wheatstone bridge can be small while still using an inexpensive meter to indicate the resistance change of the thermistor.

When using the detector, set the 2500 ohm potentiometer so that the meter is at mid-scale. Watch the meter movements as the air temperature changes and note any prolonged rises in temperature that signify thermals. The wind velocity also changes when a thermal is present and this is another sign to watch for.

Transistors are also sensitive to temperature changes. The transistor used in this circuit should be shielded from the direct sun and also well ventilated.

The 200 micro-ampere meter will be the most expensive part of the detector. Surplus meters are quite adequate and are considerably cheaper.



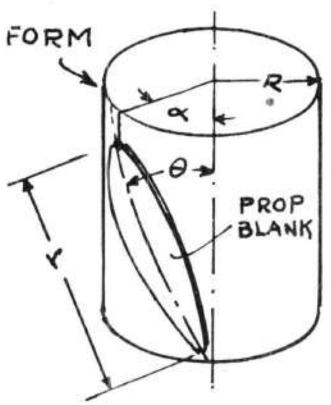
FORM FOR BENT PROPELLERS

Max Chernoff Great Neck, N.Y.

One of the motivations that brought me to build indoor models again was that I can now build props simply by bending the blades over a cylindrical form and baking to shape. I made the first one following specific instructions for only one size. To obtain other sizes I had to use cut-and-try method. Some of the results were horrible as I tried various sizes and angles. Then I decided to develop a design procedure to avoid this hit-or-miss method, and be able to make a good prop on first try.

To have similar pitch angle over the entire blade, the blade angle must change from high at center to low at tips. This variable angle or "twist" can be obtained by bending balsa sheet on a cylinder in a helical path. Numerical values for the cylinder and angle of the helical path can be determined by Trig for a particular requirement. The method used is shown below.

To avoid calculation, and since most P/D Ratios used fall between 1.0 and 2.0, a set of TABLES was prepared so that the size of the cylinder and the Helical Path can be determined without using the formulas.



r = ½ Diameter
D = Prop Diameter
R = Radius of Form
Θ = Angle of Inclination of blade on form. (Make angle template on paper on wrap on form to mark angle)
α = Angle of tip of blade in plane perpendicular to axis of can
P = Pitch of propeller

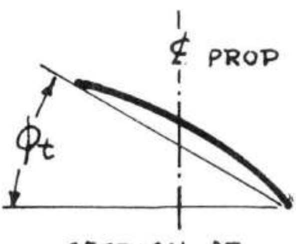
Now P/D = Pitch Diameter Ratio

and ϕ_t = Angle at tip, in degrees

then $\tan \phi_t = \frac{1}{\pi} \frac{P}{D}$

Then it can be shown that

$$\operatorname{Sin} 2\Theta = \left(\frac{2}{57.3}\right)\left(\frac{90-\phi_t}{r/R}\right)$$



SECTION AT PROP TIP

and by using Trig Tables Θ in degrees is determinate from which

$$\alpha \text{ (degrees)} = \left(\frac{r}{R}\right) \sin\Theta \times 57.3$$

Hence we can derive forming parameters on basis of (r/R) value. The following computed values are for P/D of 1.0, 1.25, 1.5, and 2.0.

Note that values of (r/R) of less than those shown result in tremendous distortion, and that values of (r/R) that are large (small cans for large props) result in excessive curvature (high camber ratio).

Your choice of P/D will determine which TABLE to use. The (r/R) Ratio will determine the size of the can or cylinder you can use. You can eliminate all stubby cans whose diameters are ¾ or greater than their heights. A 3″ dia. x 4¼″ can just makes the min. (r/R) Ratio of 3.0.

A study of the (r/R) Ratios will show that the prop diameter will determine the min. and max. diameter of cylinder you can use. A 16″ dia. prop can be made on cylinders having diameters ranging from 3¼″ to 5½″, and still be within the 3.0 and 5.0 (r/R) Ratios.

P/D 1.0

r/R	θ deg.	α deg.
3.0	28.5	82.2
3.5	22.4	76.3
4.0	19.5	76.3
4.5	16.8	74.5
5.0	15.0	74.4

P/D 1.25

r/R	θ deg.	α deg.
3.0	26.5	76.6
3.5	21.7	74.0
4.0	18.2	71.6
4.5	16.0	71.0
5.0	14.3	70.8

P/D 1.5

r/R	θ deg.	α deg.
2.5	32.3	76.5
3.0	24.5	71.2
3.5	20.2	69.1
4.0	17.1	67.5
4.5	15.0	66.7
5.0	13.4	66.3

P/D 2.0

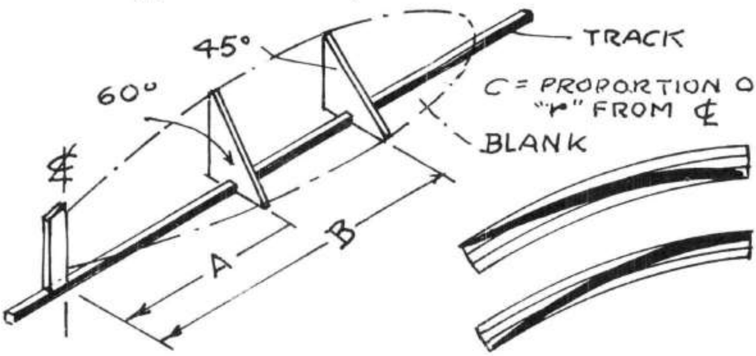
r/R	θ deg.	α deg.
2.5	26.8	64.6
3.0	21.2	62.2
3.5	17.5	60.2
4.0	15.1	59.7
4.5	13.3	59.4
5.0	12.0	59.4

Example: 8″ Dia. and 8″ Pitch. Check for (r/R) in TABLE P/D = 1. You have choice of five radius values with r = 4″. (1.3″, 1.15″, 1″, .9″ and .8″) Assuming that you have a 2″ dia. can or cylinder (1″=r), this places your prop in the 4.0 (r/R) row, in which you find θ angle to be 19.5°, and α angle of 76.3°. You can draw these angles on paper and transfer them to the can. Note that the helical path should be "r" or 4″ long between the vertical lines. Use this helical path on which to lay your prop blank.

Practical views: Determine balsa blade thickness and outline to fit your need. Open both ends of can so that both surfaces, inner and outer, are heated. To hold wet blades to the form use three or more 1/8" wide rubber bands, one on each end and others to suit. Place the blade and form in 225° F oven for 20 minutes. Do not go above this temperature and time as the balsa might char and rubber bands melt. To complete indoor prop, cement a reenforcing spar to each blade, place in angle jig and join to hub.

Outdoor props can be made from thicker sheets and carved to final form. Airfoil section and pitch variation can be sanded to suit your need. Or you can laminate two or more thin sheets together. If you want laminated blades, form the blades without cementing them together. After forming, glue them together with white glue and leave them in form overnight, sand and attach to reenforcing spars, and finish for folding or free wheeling.

To assure having the Pitch you want, and identical Pitch value in both blades, use the jig shown. Jig is used by positioning the two triangles at the calculated distance from the hub. Blade is positioned on the triangles and held there while the cement is drying at the hub. The TABLE gives the values by which the "r" is multiplied to obtain the distance of the triangles from the hub. For our 8" dia. prop and P/D of 1.0, the 45° triangle is 4 x .625 or 2½" from center, and the 60° triangle is 4 x .415 or 1.66". The construction of the jig will be left to you.



Setting for slides can be set by following formulae:

$$A = \left(\frac{c}{r}\right)_{60} \times r = \frac{30}{90-\theta_t} \times r$$

$$B = \left(\frac{c}{r}\right)_{45} \times r = \frac{45}{90-\theta_t} \times r$$

Then for given P/D ratios: →

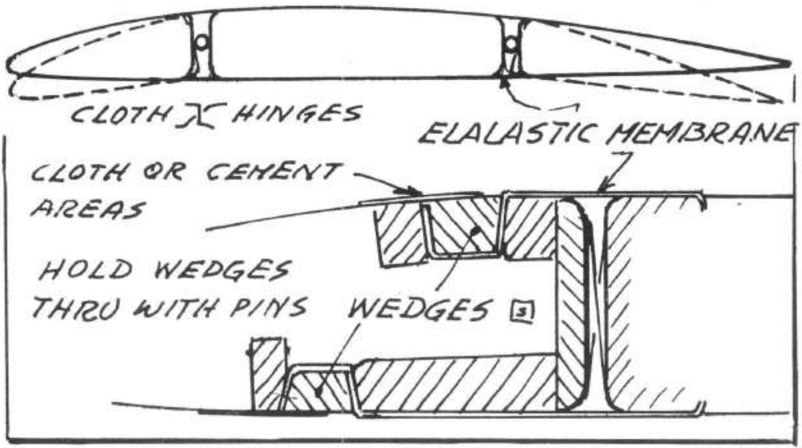
$\frac{P}{D}$	θ_t deg.	c/r 45°	c/r 60°
1.0	17.6	.625	.415
1.25	21.8	.66	.44
1.5	25.5	.70	.465
2.0	32.3	.78	.52

By using this method of forming blades you are assured of having true pitch values. It will take a certain amount of experience to pick the most desirable (r/R) Ratio, blade outline and shape, but this method allows you complete control of the basic prop characteristics and you will be able to determine which is best without too much cut-and-try.

VARIABLE CAMBER WINGS

J. Lowrie McLarty — Milwaukee, Wis.

Variable camber is desired to accommodate the model to different flight conditions. To preserve the airtightness at the hinged line I used Dental Rubber Latex, as shown on the sketch. This was tried on a U-C model. The major problem is in the forces required to move the surfaces and attaching the membrane.



Douglas Joyce — Reynoldsburg, Ohio

Lightning 11 is little different from Lightning 8, 9 and 10 but with several important exceptions. The changes are to correct a characteristic of canards which had not been fully recognized before. The problem is essentially one of bidirectional wash from the front wing over the rear wing. The inboard section of the rear wing is in a down wash just as the stabilizer is on a conventional model, however the outboard section is in an up wash. The up wash is greatest just outboard of the point where the wash changes direction and is larger in magnitude than the down wash by a factor of two or three. When the front wing is at a high angle of attack, as in gliding, a portion of the rear wing is at an even higher angle. This means that it will stall before the front wing, usually just before glide speed. The results are a nose up moment, hence a stability reduction just when stability is needed the most.

To counteract glide speed instability canards are usually flown with large stability margins, but this is not possible with present day FAI power models nor is it the most efficient. As the performance of my Lightning series models increased the problem became more critical. With Lightning 8 and on it became impossible. A number of solutions to the problem have been found, three of which have been incorporated into Lightning 11. The airfoil of the front wing was changed to induce stall at a lower angle. An autoelevator was added to the front wing. Most important the airfoil just outboard of the dihedral break has been modified to reduce its incidence and prevent early stall.

WIND TUNNEL TESTING

Lorin Roberts Newport Beach, Calif.

First, a few facts about the Wind Tunnel. It is $11\frac{1}{2}$ feet long, 9 in. x 9 in. at the entrance area, and $1\frac{1}{2}$ in. x 9 in. in the test section. Since it was primarily designed as a smoke tunnel, it has a constant height throughout with the exception of a newly added fan section. From the entrance to the exhaust, there are five distinct sections.

The first one is the settling section where the incoming air is straightened by a series of honeycomb blocks. Next, is the contraction section, where the air speed is increased by the gradual reduction of area. The smoke ejector manifold is positioned in the center of the contraction section. Then comes the test section.

Models from six to eight inch chord lengths can be accommodated without severe blocking effects. Air leaving the test section is expanded very slowly through the diffuser to the fan area which becomes circular in shape.

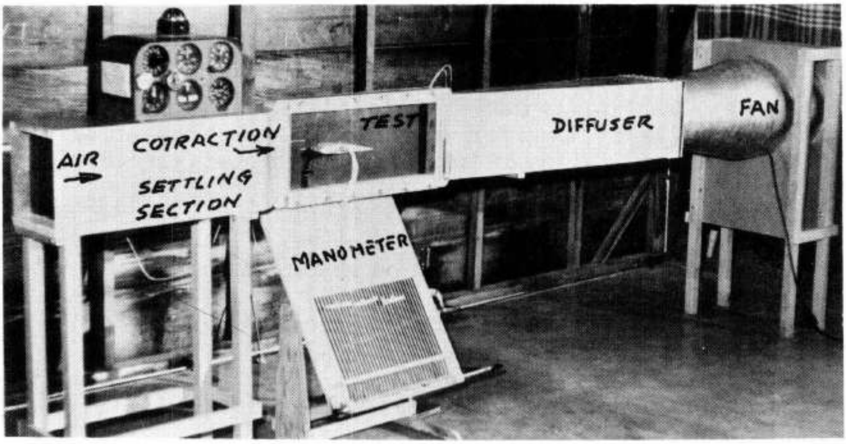
The tunnel is powered by a $\frac{1}{2}$ H.P., 3450 rpm motor rotating a six-bladed, 15 in. pitch prop. Air speed in the test section is 62 mph at a pressure of 30.0″ of mercury, or equivalent of 170 ft. above sea level.

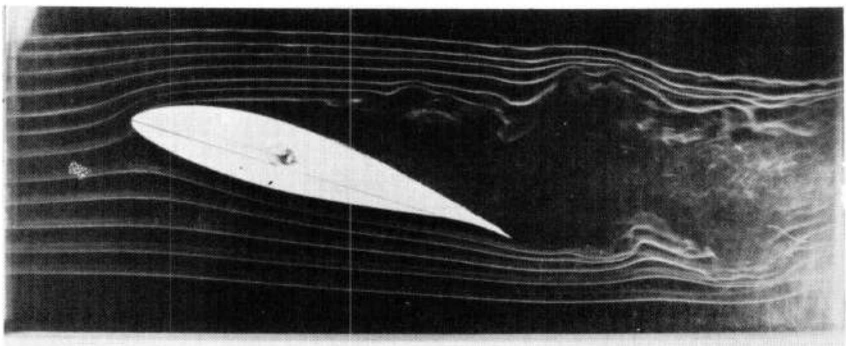
The testing equipment consists of a smoke generator, ejector manifold and an integrated multiple manometer. The streamers of white smoke that are ejected into the air stream from the manifold are produced by heating kerosene over a hot plate and moving the vapor with a small squirrel cage fan to the tunnel.

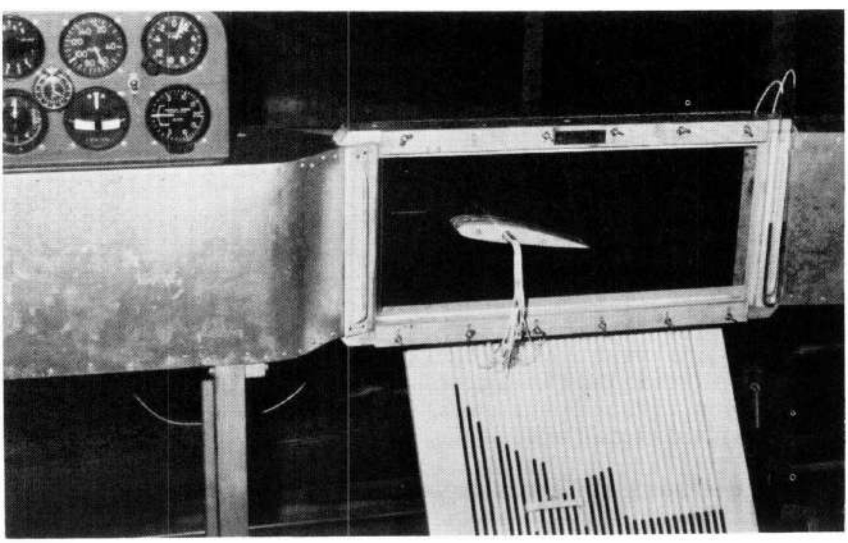
In addition to visualizing flow patterns with smoke, relative pressure distributions can be determined with the manometer. This apparatus consists of a vertical bank of glass tubes connected at the bottom to a common horizontal reservoir (filled with colored alcohol), and connected at the top to individual tubes leading to different stations along the airfoil. The open end of these tubes, lying flush with the surface of the airfoil are the means through which pressure variations are registered on the manometer.

The approximate cost of developing the wind tunnel, including building several tunnels over a five year period, materials and outside labor, is \$600.00. To duplicate a similar tunnel, the cost of material would be about \$150.00.

Lorin began building "smoke tunnels" in July, 1960, few months before entering the 7th grade. Made three successful tunnels to date. His mother does not like the smoke aroma, but enjoys seeing people who come to help him.


AIR
COTRACTION
TEST
DIFFUSER
FAN
SETTLING
SECTION
MANOMETER





HOMEBUILT CLUBHOUSE

Wilfred Weisensee Dundas, Ont., Canada

It is almost nine years since I came to this country. They went by like a wind. This Continent is exactly like they say in the old country: America is the continent of the unlimited possibilities.

I have built nearly 200 models, and accumulated a Scale Library of 35 (10" x 12") folders with 350-400 pages in each. They contain more or less complete information on almost 2000 full size aircraft.

The biggest asset of our club, Dundas Model Aircraft Club, is the Clubhouse. It seems to hold members together better than anything else I know. Maybe it is because every bit was built by them. To write how two grown-up non-professionals and 15 kids, from 10 to 15 years of age, did it and what happened while we were doing it would fill a book. This book, turned into a movie, would get an "Oscar" at least. You never did see in your whole life a group of boys display so much energy, ingenuity and self sacrifice and spirit as these boys did.

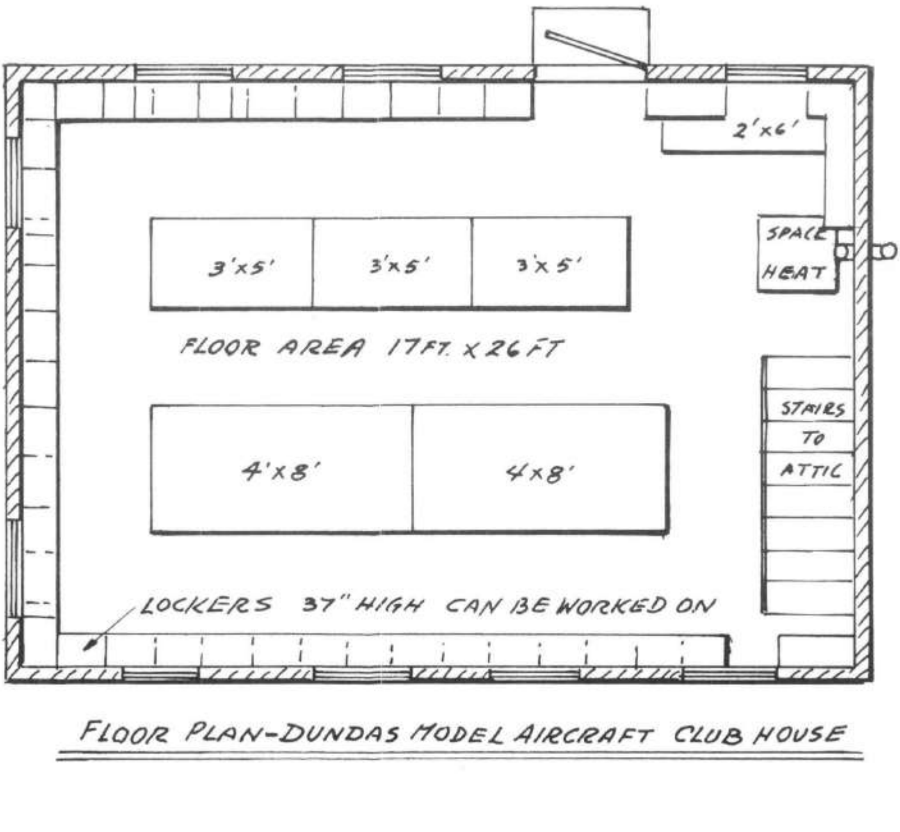
Our clubhouse was built from the remains of an old horse-and-buggy barn, and did not leave us very much choice in size and design. Our funds were very limited. In fact, during the two years which took us to complete the project, inside and out, we could only scrape together $88.00. It took every penny of it to pay for the extra material which we could not scrounge.

See the enclosed plans. The building is well insulated and lighted with fluorescent lamps. It has enough racks and shelves to store about 200 models and all of the club's belongings. It is situated on city property and our annual payment to the city is $1.00.

I have just realized that I will not be able to cram nine years of modelling and activities of our club into one letter. With this letter I will send three albums of club activities, and two folders of pictures of my own models and projects. You can go through them and pick out what you want or on what you would like to get more information.

Right now I am in the middle of completing an old wish of mine, to design all kinds of sportmodels which will look like airplanes but behave like good models. To make them available to as many youngsters as possible, I will design about a dozen different fuselages which will take similar engines, wheels and only a few different wings. So far have completed fuselages for a cabin model, low wing, midwing, biplane and high wing pusher. Will use three wings, differing only in dihedral, 5°, 10° and 15°. Will have two stabilizers with different areas, and also a "V" stab which will be adaptable to all models.

Time and space did not allow inclusion of Wilfred's models in this edition, but they will be in the next edition.



FLOOR PLAN-DUNDAS MODEL AIRCRAFT CLUB HOUSE

NEEDED DEVELOPMENTS

Roger Schroder Overland Park, Kans.

1. Angle of Attack Recorder, high priority.
2. Glide Angle Recorder.
3. Air Speed Recorder.
4. Good data on airfoil characteristics at model speeds.
5. Airfoil developed especially for model speeds.
6. Profile drag data on model shapes at model speed.
7. A simple automatic device to cause model to circle up wind and eliminate long distance retrival problems.
8. A reliable mechanical DT device.
9. Design guides to follow in constructing strong, flexible, warp resistant structures.
10. An easily made, efficient, folding propeller and hub device.
11. A jig design to easily make propellers.
12. A study of aerodynamic characteristics of model props.
13. Determination of optimum Aspect Ratio for different size models.
14. A study of the materials available for construction with recommendations for application of new materials.
15. Establish better wind gust stability criteria for models under 30 in. span.
16. Devise a reliable device to change trim of a model under power and glide.

MODEL ROCKETS

G. Harry Stine New Canaan, Conn.

My present area of aeromodelling interest lies in VTO rocket powered gliders, otherwise known to model rocketeers as "Boost-Gliders."

With the model rocket engines now available, high thrust-to-weight ratios are possible, far beyond that obtained with Jetex. The total absence of torque and slipstream effects in models powered by reaction engines simplifies the powered phase problems to some extent. Their powered flight is like that of a hand-launched glider tossed by an arm 100 feet long. — And to start, no clipping fingers, just push the button.

Our smallest model rocket engine, the Uni-Jet ½A.1-3, develops an average thrust of 2 oz. (Max. thrust 5 ozs.) for 0.5 sec. The largest, the Coaster F-25-4, develops an average thrust of 25 pounds (Max. thrust 40 lbs.) for 0.4 sec. The average Boost-Glider engines, an Estes B.8-4, for example, develops a Max. thrust of 24 oz., and an average thrust of 10 oz. for as long as 1.5 sec. Since weight of the Uni-Jet is 0.27 oz., Estes 0.7 oz., and the Coaster 5 oz., you can see that we are used to working with high thrust-to-weight ratios!

For more rocket engine characteristics, see Report 22.

NAR CERTIFIED MODEL ROCKET ENGINE CHART

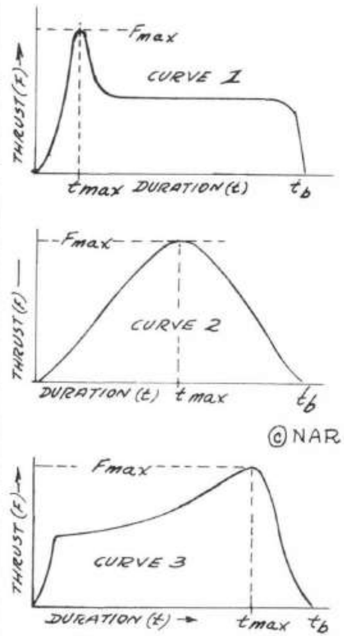
NAR TYPE	MFG.	MFG.TYPE	LENGTH (in.)	O.D. (in.)	I_t (lb-sec)	W (oz.)	W_p (oz.)	CURVE	F_{max} (lb)	t_{max} (sec)	F_{av} (lb)	t_b (sec)	t_d (sec)	REMARKS
1/2A1-0	EI,CE	1/4A.8-0	2.75	0.69	0.17	0.46	0.06	2	23 oz.	0.15	1.0	0.3	0	Booster only
1/2A1-0	EI	1/4A.8-0S	1.75	0.69	0.17	0.34	0.06	2	23 oz.	0.15	1.0	0.3	0	Short booster
1/2A1-2	EL,CE	1/4A.8-2	2.75	0.69	0.17	0.50	0.06	2	23 oz.	0.15	1.0	0.3	2	
1/2A1-2	EI	1/4A.8-2S	1.75	0.69	0.17	0.38	0.06	2	23 oz.	0.15	1.0	0.3	2	Short case
1/2A1-4	EI,CE	1/4A.8-4	2.75	0.69	0.17	0.51	0.06	2	23 oz.	0.15	1.0	0.3	4	Top stage
1/2A1-4	EI	1/4A.8-4S	1.75	0.69	0.17	0.39	0.06	2	23 oz.	0.15	1.0	0.3	4	Short top stage
1/2A.8-0	EI,CF,RD	same	2.75	0.69	0.35	0.49	0.15	1	23 oz.	0.15	14 oz	0.6	0	Booster only
1/2A.8-0	EI	1/2A.8-0S	1.75	0.69	0.35	0.37	0.15	1	23 oz	0.15	14 oz	0.6	0	Short booster
1/2A.8-2	EI,CE,RD	same	2.75	0.69	0.35	0.54	0.15	1	23 oz	0.15	14 oz	0.6	2	
1/2A.8-2	EI	1/2A.8-2S	1.75	0.69	0.35	0.42	0.15	1	23 oz	0.15	14 oz	0.6	2	Short case
1/2A.8-4	EI,CE,RD	same	2.75	0.69	0.35	0.55	0.15	1	23 oz	0.15	14 oz	0.6	4	Top stage
1/2A.8-4	EI	1/2A.8-4S	1.75	0.69	0.35	0.43	0.15	1	23 oz	0.15	14 oz	0.6	4	Short top stage
A.8-0	EI,CE,RD	same	2.75	0.69	0.70	0.56	0.20	1	23 oz	0.15	14 oz	1.1	0	Booster only
A.8-3	EI,CE,RD MM	same	2.75	0.69	0.70	0.60	0.20	1	23 oz	0.15	14 oz	1.1	3	
A.8-4	EI,CE,RD	A-4 same	2.75	0.69	0.70	0.63	0.20	1	23 oz	0.15	14 oz	1.1	4	Top stage
B.8-0	EI,CE,RD, MM	same	2.75	0.69	1.15	0.63	0.30	1	23 oz	0.15	14 oz	1.5	0	Booster only
B.8-2	EI,CE	same	2.75	0.69	1.15	0.68	0.30	1	23 oz	0.15	14 oz	1.5	2	Heavy models
B.8-4	EI,CE,RD, MM	same	2.75	0.69	1.15	0.71	0.30	1	23 oz	0.15	14 oz	1.5	4	
B.8-6	EI,CE,RD	B-6 same	2.75	0.69	1.15	0.73	0.30	1	23 oz	0.15	14 oz	1.5	6	Top stage
B3-0	EI,CE,RD	same	2.75	0.69	1.15	0.61	0.30	2	9 lb.	0.18	3.4	0.35	0	Booster only
B3-5	EI,CE,RD	same	2.75	0.69	1.15	0.69	0.30	2	9 lb.	0.18	3.4	0.35	5	
C.8-0	EI,CE,RD	same	2.75	0.69	1.50	0.71	0.35	1	35 oz	0.20	14 oz	2.0	0	Booster only
D2-0	PD	BE2.5-2-0	4.50	1.00	3.97	2.50	1.10	1	4.25	0.25	2.0	2.0	0	Booster only
D2-8	PD	BE2.5-2-8	4.50	1.00	3.97	2.50	1.10	1	4.25	0.25	2.0	2.0	8	
D2-13	PD	BE2.5-2-13	4.50	1.00	3.97	2.50	1.10	1	4.25	0.25	2.0	2.0	13	Top stage
D3-0	PD	BE3.5-1-0	3.00	1.125	2.19	2.20	0.70	1	5.75	0.45	3.0	1.0	0	Booster only
E2-0	PD	BE2.5-3-0	5.625	1.00	7.75	3.30	1.80	1	4.25	0.25	2.0	3.0	0	Booster only
E2-12	PD	BE2.5-3-12	5.625	1.00	7.75	3.30	1.80	1	4.25	0.25	2.0	3.0	12	
E2-17	PD	BE2.5-3-17	5.625	1.00	7.75	3.30	1.80	1	4.25	0.25	2.0	3.0	17	Top stage
E3-0	PD	BE3.5-2-0	4.00	1.125	4.95	2.80	1.00	1	5.75	0.45	3.0	2.0	0	Booster only
E3-10	PD	BE3.5-2-10	4.00	1.125	4.95	2.90	1.00	1	5.75	0.45	3.0	2.0	10	
F2-0	PD	BE-2.5-4-0	7.125	1.00	10.20	4.20	2.30	1	4.25	0.25	2.0	4.0	0	Booster only
F2-15	PD	BE2.5-4-15	7.125	1.00	10.20	4.20	2.30	1	4.25	0.25	2.0	4.0	15	
F2-20	PD	BE2.5-4-20	7.125	1.00	10.20	4.20	2.30	1	4.25	0.25	2.0	4.0	20	Top stage
F3-0	PD	BE3.5-3-0	5.00	1.125	8.10	3.90	1.90	1	5.75	0.45	3.0	3.0	0	Booster only
F3-14	PD	BE3.5-3-14	5.00	1.125	8.10	3.90	1.90	1	5.75	0.45	3.0	3.0	14	
F3-18	PD	BE3.5-4-18	6.00	1.125	11.95	4.40	2.20	1	5.75	0.45	3.0	4.0	18	
F11-0	CC	20-pound	8.00	1.062	11.0	5.00	3.00	3	20	0.80	11	1.0	0	Booster only
F11-3	CC,CE	20-Pound	8.00	1.062	11.0	5.00	3.00	3	20	0.80	11	1.0	3	Payload engine
F15-0	CC	30-pound	8.00	1.062	14.1	5.00	3.00	3	30	0.45	15	0.7	0	Booster only
F15-4	CC,CE	30-pound	8.00	1.062	14.1	5.00	3.00	3	30	0.45	15	0.7	4	Payload engine
F25-0	CC	40-pound	8.00	1.062	15.5	5.00	3.00	3	40	0.35	25	0.45	0	Booster only
F25-6	CC	40-pound	8.00	1.062	15.5	5.00	3.00	3	40	0.35	25	0.45	6	Payload engine

O.D. = Outside Dia.
W = Loaded Eng. Wt.
F_{max} = Max Thrust
F_{av} = Aver. Thrust
T_d = Time Delay

I_t = Total Impulse
W_p = Propellent Wt.
t_b = Thrust Duration
T_{max} = Time after ignition of Max Thrust

EI = Estes Ind. Inc.
CC = Coaster Corp.
CE = Century Eng. Co.

RD = Rocket Develop. Co
MM = Model Missiles Inc
PD = Propulsion Dyna.



THRUST-TIME CURVES

MODEL BUILDER AND AERONAUTICAL ENGINEER

J. Gregory Krol Bellflower, Calif.

Thanks for your letter of 1 August, 1964. I would like to expand on some of the points I tried to make originally, and to comment on some of your remarks.

First, let me put in a plea of not guilty for "the aero engineers (who) are also in the dark." It is, I suggest, only fair to realize that there are many rather distinct areas of interest in Aeronautical Engineering. In any Airplane Works you can find Aero Engineers studying structures, flutter and vibration, weight, propulsion, aerodynamics, performance, cost effectiveness, hydraulic of electrical or hot gas or pneumatic actuation, aerodynamics loads, landing loads and shock, instrumentation, a myriad of the aspects of manufacturing and production, logistics and spares, ground support equipment, maintenance procedures, detail design, environmental and other sorts of testing, and an almost endless number of other tasks. Yet, how many, of just this sample I have listed, have any direct application to models? Hmnn, you suggest, how about aerodynamic performance? That ought to apply.

Very well, Frank, if you want to know how much increase in range you will get by running boron fuel instead of kerosene in your model turbojet, if you want to know how high to launch your model satellite in order to place it in a synchronous orbit, if you want to know how the turning radius of your model will affect ground radar and digital computer requirements for the average high altitude interception mission, if you want to know how much more fuel your model will burn at Mach .95 as compared to Mach .90, if you want answers to any of thousands of questions like these, I am sure there is somewhere an AE who can help you.

And I have not started to talk about the AE's who work on things little related to airplane flight, like Internal Aerothermo Dynamics, Magneto Plasma Dynamics, Hydrofoils, GEMS, Submarines, Reentry Vehicles, Rocket Combustion Chambers and Nozzles, Helicopters, or for that matter Window Fans. All of these things look like aeronautical engineering, I am sure you will agree, but none of them have any reasonably close connection to models.

It would be unreasonable to suppose that a guy who was expert in designing 8 ton forged aluminum wing spar has some magical ability to transfer his experience to the design of a 8/10 ounce balsa spar. On the contrary, I would argue that if he does show some proficiency in the latter case, it is highly meritorious and a remarkable demonstration of the validity of his design principles. The extent to which the interests and practice of Aeronautical Engineers differ from those of Modelers is shown in a convincing manner by scanning through the "Aerodynamics" section of Eshbach (Ovid W. Eshbach HANDBOOK OF ENGINEERING FUNDAMENTALS, John Wiley & Sons, Inc., 1952 and later editions. A reference book without which you should not be).

But having shown you, I hope, that most of the work done by Aeronautical Engineers is simply not applicable to models, let me try to identify some portions which ARE. These applicable factors can probably be lumped into three categories:

FIRST: Aerodynamics. By which I mean properties of wing sections, drag of fuselage, three dimensional wing theory, etc. As you well know, modelers seem to have a helpless fascination with "airflow" and "streamlining" and the like. Considering the Reynolds Numbers Range of models, the practical, constructional difficulties in building an accurate airfoil, or what not, to model scale, and the very real problems in experimental determination of the effect of a given wing section, etc., it seems to me that the importance of this area is grossly exaggerated. To illustrate, I have heard modelers argue about the relative "stability" of various airfoils, then casually trim their planes by shifting the Center of Gravity — without ever suspecting the drastic effect of stability that is caused by moving the C.G.! I would suggest that the average contest modeler is already rather over-concerned with aerodynamics, and additional emphasis in this area would be superfluous.

The SECOND contribution from Aeronautical Engineering might be called General Principles. Even when the various esoteric studies of AE's have no direct application to models, they frequently reveal certain useful principles, or grounds rules or, if you like, rules of thumb. For instance, the propeller types can tell you that significant increases in Thrust Power (as opposed to shaft power developed by the engine, but practically dissipated in losses) can be obtained with larger diameter propellers that have their pitch and blade width suitably reduced to allow the engine to reach its peaking speed. The structure boys can show how a constant section beam, as are almost all model wings, can be replaced by a constant strength beam — yielding both greater strength and lighter weight simultaneously. Ideas like these are, I think, entirely worth while. While they make no pretense of telling the modeler where his goal is, they can indicate the direction in which he should look for it, and thereby eliminating a lot of misplaced effort.

The THIRD contribution area is the most important, I believe, and nothing better illustrates its importance than the fact that almost everything you have written in your books is concerned with it. At the same time it provides the subject matter for the most heated disagreements, and for the most disheartening disappointments for the modeler, whether beginner, average or expert. It is known as Performance, Stability and Control, as Aircraft Dynamics, or as Flight Mechanics. The thing that is completely surprising in light of the importance of this subject to modelers, is that a very large part of it, what I think the most important part, can be applied directly to models. That so little of Aircraft Dynamics has been applied to models is probably due to two things.

"First" is the conceptual nature of the subject. It is concerned with understanding the way in which vehicles or missiles behave, and it is difficult or meaningless to try to fragment it into a lot of isolated bits and pieces.

The "Second' 'thing is really pretty simple, and it is why I went into such detail about the wide variety of things that Aeronautical Engineers work on. The Aircraft Dynamicists are but one tiny fraction of all Aero Engineers. You probably know more about aircraft dynamics than the "average" AE. Even so, it is the CONCEPTUAL FRAMEWORK that can be provided by the Aircraft Dynamics which I see as of primary interest. Most problems have an appearance of forbidding complexity if one does not have a way of thinking about them, but reduced to routine irritations when one acquires such a conceptual framework. A good example is your own discovery of Pitching Moment calculations. Can you recall back to the days before you knew about these, and believe some of that sense of mystery, magic and frustration in Longitudinal Trim and Stability, C.G. Position, and Incidence Angles? Now that you know how to attack the problem, you find that it mostly solves itself.

Now let me make a few other comments. You said that if you had been smart, you would have "built a lot of models and competed like hell" to put them across. Unfortunately, it is only too true that many modelers tend to copy. What has won contests must be good. What has not been used by contest winners cannot be good. But fashions change, don't they? This would indicate that what was "right" yesterday is "wrong" today, an attitude to which I am sure you do not subscribe. The problem seems to be that modelers have so little understanding of what their planes are doing that they will try, at least for a while, almost literally anything. This is why I have stressed the importance of sound Conceptual Framework of understanding model flight.

An example of this sort of thing is in your own letter. You speak of a "Power to Weight Ratio" of "more than One if that is possible." I must disagree. It is not a question of whether or not it is possible. It is a question of whether or not that is MEANINGFUL. In a rather precise sense, Frank, it is MEANINGLESS to talk about Power to Weight Ratios of less or greater than One. While the phrase Power-to-Weight Ratio seems temptingly similar to the phrase Thrust-to-Weight Ratio, the conceptual difference between them is so vast as to prohibit any non-trivial interchangeability of the two. Again I come back to my theme: The detailed applications are often far less important than a fundamental understanding of the concept.

Thrust-to-Weight Ratio is dimensionless, while Power-to-Weight Ratio is not. This means that the numerical value of P/W can be arbitrarily changed by changing the units of measurement. This is not to say there is something "wrong" with P/W as a design parameter. What it means is that the designer or flyer who does not appreciate the basic form of the relations he is working with is pretty helpless; worse than that, he is likely to be misled into a series of blind alleys. How well understood are such basic ideas as the difference between Angle of Attack and Angle of Incidence? Downthrust is the angle between the propeller shaft and — what?

Sometimes I wonder about the "boys who are trying very hard" but who are deliberately limiting themselves to the dull tools and second-rate methods. I have met model builders who would build — and wreck molels at a tremendous rate, and with an equally tremendous cost in terms of time, money and effort, but who would not dream of reading a book or article that explains the solution to their problem. Cut-and-try is no virtue when the problem could be solved more easily by analyzing it; conversely, trial-and-error is no vice when the only alternative is empty speculation.

- - —— — — - - books or references — — — AIRCRAFT PERFORMANCE, STABILITY and CONTROL by Perkins and Hage. (Wiley & Sons). A book devoted almost exclusively to Aircraft Dynamics, and a very good one too, is DYNAMICS OF FLIGHT by Etkin. (Wiley & Son). An excellent buy is DYNAMICS OF THE AIRFRAME by Northrop Aircraft. $4.25 Hawthorne, Cal.

The Northrop Volume (it is one of a series) came out in Sept. 1952 .To show the sort of things in it, and vis-a-vis Circular Airflow:

> The Stability Derivative Cmq is the change in Pitching Moment Coefficient with varying pitch velocity and is commonly referred to as the Pitch Dampening Derivative. As the airframe pitches about its Center of Gravity path, the Angle of Attack of the horizontal tail changes, and a lift force is developed on the horizontal tail producing a Negative Pitching Moment on the airframe and hence a contribution to the Derivative Cmq.
>
> There is also a contribution to Cmq because of various "dead weight" effects. Since the airframe is moving in a curved flight path due to its pitching, a Centrifugal Force is developed on all the components of the airframe. The force . . . can cause the horizontal tail angle of attack to change as a result of fuselage bending . . .
>
> In low speed flights, Cmq comes mostly from the effect of the curved flight path on the horizontal tail and its sign is negative. In high speed flight the sign of Cmq can be positive or negative, depending on the nature of the aeroelastic effects.
>
> The Derivative Cmq is very important in Longitudinal Dynamics because it contributes a major portion of the damping of the short period mode for conventional aircraft. As pointed out, this damping comes mostly from the horizontal tail. For tail-less aircraft, the magnitude of Cmq is consequently small. This is the main reason for the usually poor dampening of this type of configuration. Cmq is also involved to certain extent in the damping of the Phugoid Mode. In almost all cases, high negative values of Cmq are desirable.

That is part of the discussion on Cmq and, of course, represents one facet of Circular Airflow. There are thirty (30) other derivatives discussed in a similar manner, and all this is just one section of the volume. There is a lot of information here!

DESIGN COMMENTS

Don Lindley Crown Point, Ind.

H. L. GLIDER: This model is specifically designed for the older group who have to work up to the three big launches per contest. I found, when I tried to get back into H. L. Glider after too many pounds and years, that my arm would only take about a half dozen full force launches before it became unglued. Since a conventional Left Turn Glide-Right Bank launch glider can only be adjusted at full bore, I ended up with a sore arm and lousy adjustment. Rather than go through an intensive phys-ed program I went to the drawing board and tried to work out an adjustment which would produce the same recovery no matter how hard it was thrown.

The first thing I had to do was ditch the Right Bank, since the rollout of this system depends entirely on the time from launch to rollout. While I was at it I figured "Why not throw overhead?" This is the most efficient throwing configuration. (Ever see a major league pitcher throw a fast ball side-arm?)

Suddenly it occurred to me that I had been using the adjustment I wanted on F.F. gas for years. All I had to do was tilt the stab for glide turn and use rudder and elevator for climb pattern. While I was at it, I tilted the stab on one side only to give some effective anhedral to keep the nose up in a flat, yawed turn and reduce the dihedral of the wing since I no longer had to worry about recovery from roll.

The whole thing worked out beautifully. The glider can be thrown hard or soft, straight up or straight out and it never fails to give a smooth transition into the gliding turn. Incidentally, if the C.G. is placed too far aft, the model glides in *square* circles. As the nose drops from a stall the model straightens out until it approaches the next stall and speed drops. At that point the turn takes over and the model makes about 90° before the nose drops, etc. Pretty weird.

JETEX: This is strictly for kicks airplane. The original was built in '46 and changes since then have only been in thrust line, dihedral, etc. Glide turn is adjusted via stab tilt and climb with rudder. Pattern is Right-Right and flights are too long for an old man. The nose is cut back so that the tail sticks up in the air when the model lands. This is the only way you can find the thing in tall grass.

This is the thirteenth model in this series. I now have eleven charges left from the prior twelve units and I have never bought an extra box of charges. The six which come with the engine have always been adequate to lose the model. The first one (in '46) was returned once from two hundred miles away and promptly lost again; permanently.

DELTA: This model is the third in a series of offset engine control line trainers designed for a kid with bad coordination. (My five-year old, now six.) He could not cope with the speed of the conventional trainers, so I took the only approach I could to keep the lines tight while reducing the speed. The first two had standard symmetrical foils and had to be built in a jig. The diamond foil is strictly to simplify building.

The model is built by making up the bellcrank, wheel and leading edge sub-assembly on the plywood square and attaching the engine mount and vertical stiffeners. The trailing edge is pinned down on the board and the center and tip ribs are put in place. Then the sub-assembly is glued on up side down and the rest of the ribs are put in place. The bottom L.E. sheeting is glued on and the wing is lifted. Top L.E. sheeting is put on, and fins, flippers and fairings are installed. The engine mount fairings are put in place and the *inside* tip is weighted to get the C.G. in the right place. Lead-outs, fins, etc., finish the job.

All three models have used the Cox Babe Bee and were flown on 50 ft. .012 lines. The models go about 30 mph which gives the kid about eighteen seconds per lap. Take-off is slow (about ¼ lap) and landing is slow and easy (just hold neutral). This model has been eminently successful.

CLASS "A" F.F.: In 1954 Harry Shoaf of the NACA designed a series of foils for model use in his low R.N. wind tunnel. The most outstanding of these was the 4758 D.F. I used this foil in a Nordic A/2 in 1955 and have used it in ½A F.F. since then. In 1961 I built a A/1 Nordic using the same section at 70% of the original thickness. The model had a fantastic hanging glide. So I subsequently built an A/2 using the same foil. This glider also showed lower sink rate than the original A/2. In 1962 I faced building an "A" F.F. for the Nats and decided to try Shoaf's foil in a little larger ship.

With the removal of the loading rules the answer seemed to be a large, light airplane with good transition from climb to glide. I built two"A"s; one with flat bottom foil and the other identical in every respect except for the 4758 DF foil. The models were trimmed from April to July at which point it was obvious that the 4758 DF job was outperforming the other from every angle. I therefore concentrated on it and flew it at the Nats.

I would like to say that the Foil won every event entered, but the facts are these:

1. The "A" job dee-teed from its second max into a barn roof and slid off on a wing tip clobbering the whole panel.
2. The "A/2" D.T. failed on the first morning test hop and was lost..
3. The "A/1" found every hole in the air and after three flights of under a minute I went home and slashed my wrists. Oh, for the life of the happy contestant!

The foil is not easy to trim for power flight. It is at its best on gliders. However, on a large light job it is worth the effort.

Brian Roots — New Zealand

I am a friend of John Malkin and he shares your letters with me. I hope that our efforts in providing drawings of selected New Zealand models will assist in the preparation of yet another Year Book. We have genuinely tried to select the outstanding competition models in N.Z. today and this is difficult when the core of the top contest men is small and many overseas designs are flown.

In reviewing my own clutch of competition models I was surprised to find only three out of eight are my own design, when at one time it was a matter of pride that all my models were O.D. I think "pride" is the operative word here. Now I take my free flight competition seriously and, if I recognize the merits of another's design, I will build it.

I certainly appreciate now, if I did not before, the colossal amount of work you have done in the preparation of these books. I hope the tracings are of acceptable standard. I have left the wood-grain shading for you to do or not, as you see fit. I think your shading is much of the character of the Y.B. and was afraid I could not reproduce it faithfully.

I have been only too pleased to make a small contribution to the book and would ask only if I may have an autographed copy !

Gordon A. Hilliam — Canada

You will note my amendments to the plans as published in the "Airfoil". I will be flying similar models in the World Champs with the following small mods:

The nose now has a spinner and the wings sport turbulators. These are 1/32 sq. spruce strips cemented 3/16 back of the nose radius. The effect has been to de-sensitize the stall; allowing a close trim without a stall developing in gusty conditions. They do not increase performance other than improve the consistency. Although, when used on A. Wisher's glider "Wishbone", the times jumped from about 90 secs. without turbulation to 150 secs. with turbs. It all seems very dependent on airfoil characteristics, and the generalization I can make on this is that airfoils with upper camber well forward are sometimes helped in performance by the addition of turbulators.

When using silk or nylon covering — to fill the pores of the material, usea s a first coat Knox's unflavored gelatine. Heat one cup of water to a boil, put in a bowl, mix in the contents of one envelope of Knox's unflavored gelatine. When dissolved, brush on covering. It can also be used as an adhesive. One coat is enough. Clear or colored nitrate or butarate dope goes on just fine. It saves at least three coats of dope. — WALTER KULZER, Ft. Worth, Tex.

Wakefield Results

1.	G. Reich	U.S.A.	180	180	180	180	180	900 +210
2.	J. Kosinski	Poland	180	180	180	180	180	900 +207
3.	A. Alinari	Italy	180	180	180	180	180	900 +169
4.	L. Azor	Hungary	180	180	167	180	180	887
5.	W. Niestoj	Poland	180	180	162	180	180	882
6.	L. Riffaud	France	180	160	180	180	180	880
7.	W. Zapaschni	U.S.S.R.	180	180	155	180	180	875
8.	E. Fresl	Yugoslavia	180	180	180	180	154	874
9.	S. Sjogren	Sweden	180	150	180	180	180	870
10.	J. Petiot	France	180	145	180	180	180	865
11.	J. Osborne	Netherlands	180	180	152	167	180	859
12.	E. Hamalainen	Finland	180	180	136	180	180	856
13.	K. Bousfield	Canada	174	180	180	149	172	855
14.	I. Ivannikov	U.S.S.R.	171	154	169	180	180	854
15.	G. Rupp	Germany	180	129	180	180	180	849
16.	G. Krizsma	Hungary	159	180	145	180	180	844
17.	W. Kmoch	Yugoslavia	180	180	180	136	164	840
18.	U. Axelsson	Sweden	139	180	180	180	158	837
19.	G. Roberts	G.B.	142	180	180	180	147	829
20.	J. Sokolov	U.S.S.R.	180	158	180	126	180	824
20.	P. Breith	Austria	173	180	180	111	180	824
21.	J. Patterson	U.S.A.	180	180	101	180	180	821
22.	St. Zurad	Poland	129	180	180	180	149	818
23.	K. Leissner	Germany	180	170	180	137	149	816
24.	B. Storgards	Finland	168	136	148	180	180	812
25.	C. Perkins	U.S.A.	152	180	116	180	180	808
26.	J. Merori	Yugoslavia	180	180	180	127	129	796
26.	R. Artioli	Italy	136	178	180	180	122	796
27.	P. Aalto	Finland	180	180	180	66	180	786
28.	B. Murari	Italy	131	159	135	180	180	785
29.	R. Kieft	Netherlands	180	180	120	180	123	783
30.	C. Meseburger	Spain	123	158	180	135	180	776
31.	D. Mackenzie	Canada	127	180	180	122	166	775
32.	N. Elliott	G.B.	175	180	151	180	85	774
33.	O. Ehmann	Germany	180	153	110	180	143	766
34.	E. Tammel	Austria	138	180	180	180	82	760
35.	M. Segrave	Canada	154	77	155	178	91	755
36.	L. Flodstrom	Sweden	153	180	180	86	153	752
37.	F. Fernandez	Spain	178	115	96	180	180	749
38.	M. Rohlena	Czechoslovakia	178	116	180	145	129	748
39.	R. Liechti	Switzerland	180	169	129	112	154	744
40.	P. Lust	Netherlands	157	88	131	180	180	736
41.	J. O'Donnell	G.B.	126	121	138	180	165	730
42.	E. Nienstedt	Denmark	172	180	133	180	60	725
43.	P. W. Visser	South Africa	180	172	113	134	125	724
44.	J. Malkin	New Zealand						
	Proxy: G. Maibaum	Germany	136	180	171	92	136	715
45.	P. Rasmussen	Denmark	180	122	115	156	139	712
46.	E. Frigyes	Hungary	77	180	128	180	138	703
47.	A. Rodrigues	Portugal	180	180	117	68	154	699
48.	E. Balasse	Belgium	180	148	95	177	91	691
48.	A. Sereno	Portugal	107	129	153	174	128	691
49.	E. Hegglin	Switzerland	113	81	180	172	144	690
50.	J. Fontaine	France	180	129	85	108	180	682
51.	P. Grunbaum	Austria	180	180	94	102	119	675
52.	N. Hewitson	New Zealand						
	Proxy: Waldhauser	Germany	108	91	144	150	179	672
53.	L. Muzny	Czechoslovakia	138	180	151	91	105	665
54.	J. Cunderlik	Czechoslovakia	83	180	103	150	135	651
55.	H. Dahl	Norway	180	161	63	136	99	639
56.	W. Cook	New Zealand						
	Proxy: M. Schmidt	Germany	118	145	156	102	116	637
57.	J. Meier	Switzerland	126	101	164	112	131	634
57.	A. Simonsen	Norway	96	129	180	67	162	634
58.	V. Matute	Spain	90	115	99	103	109	516
59.	N. Stovland	Norway	126	117	147	—	92	482
60.	M. Sousa	Portugal	145	58	85	23	166	477
61.	H. Mikkelsen	Denmark	110	85	91	51	61	398

Wakefield Team Results

1.	Poland	2600	8.	Hungary	2434
2.	U.S.S.R.	2553	9.	Germany	2431
3.	U.S.A.	2529	10.	France	2427
4.	Yugoslavia	2510	11.	Canada	2385
5.	Italy	2481	12.	Netherlands	2378
6.	Sweden	2459	13.	G.B.	2333
7.	Finland	2454	14.	Austria	2259

F.A.I. Power Results

1.	F. Schneeberger	*Switzerland*	180	180	180	180	180	900
2.	E. Frigyes	*Hungary*	180	162	180	157	180	859
3.	J. Cerny	*Czechoslovakia*	180	180	161	180	153	854
4.	J. Sheppard	*New Zealand*						
	Proxy: P. Buskell	*Great Britain*	132	179	180	180	180	851
5.	A. Meczner	*Hungary*	158	180	137	180	180	835
6.	E. Verbitki	*U.S.S.R.*	160	176	149	175	171	831
7.	G. Parry	*Canada*	153	180	134	180	180	827
8.	H. Raulio	*Finland*	180	102	180	180	180	822
9.	K. H. Rieke	*Germany*	180	102	161	180	180	803
9.	**G. R. French**	**Great Britain**	180	134	129	180	180	803
10.	S. Ranta	*Canada*	180	131	124	180	180	795
11.	V. Hajek	*Czechoslovakia*	180	180	103	180	151	794
12.	**R. Monks**	**Great Britain**	179	160	180	101	166	786
13.	W. Horcicka	*Austria*	180	138	96	180	180	774
14.	M. Eriksson	*Sweden*	128	180	180	180	105	773
14.	J. Fontaine	*France*	180	115	180	173	125	773
15.	H. Wagner	*Austria*	180	86	180	180	138	764
16.	R. Cerny	*Czechoslovakia*	122	180	144	154	160	760
17.	G. Simon	*Hungary*	137	126	162	180	143	748
18.	E. Eng	*Switzerland*	85	180	168	180	133	746
19.	S. Pimenoff	*Finland*	180	166	86	180	126	738
20.	**A. Young**	**Great Britain**	116	159	102	180	180	737
21.	M. Bjelajac	*Yugoslavia*	180	115	180	152	98	725
22.	L. Larsson	*Sweden*	118	180	180	120	118	716
23.	D. Surrey	*Canada*	174	106	179	132	120	711
24.	R. Schenker	*Switzerland*	90	180	78	180	180	708
25.	J. Soares	*Portugal*	136	126	125	180	137	704
26.	R. Guilloteau	*France*	129	81	151	180	156	697
27.	E. Padovano	*Italy*	136	143	97	140	180	696
28.	K. H. Becker	*Germany*	131	180	180	89	114	694
29.	G. Guerra	*Italy*	79	180	112	141	180	692
30.	W. McCormick	*U.S.A.*	127	121	180	180	79	687
31.	J. Thomson	*Ireland*	175	106	82	143	180	686
32.	P. Billes	*Austria*	73	161	85	180	180	679
33.	M. Van Dijk	*Netherlands*	160	166	109	84	142	661
34.	G. Poorman	*U.S.A.*	162	103	81	125	180	651
35.	B. Filimonov	*U.S.S.R.*	92	180	78	180	117	647
36.	A. Stepanovic	*Yugoslavia*	119	145	180	161	39	644
37.	R. Hagel	*Sweden*	71	101	107	180	180	639
38.	V. Pecorari	*Italy*	107	120	94	180	134	635
39.	J. Benedik	*Yugoslavia*	132	82	102	129	180	625
40.	P. Laxmann	*Finland*	47	180	96	180	119	622
41.	Kusara-Ma	*Japan*						
	Proxy: R. Schwenn	*Germany*	122	89	114	180	109	614
42.	B. Bulukin	*Norway*	127	78	138	138	129	610
43.	Jwaj	*Japan*						
	Proxy: W. Zwilling	*Germany*	89	163	118	142	91	603
44.	Z. Sulisz	*Poland*	130	98	161	167	18	574
45.	I. Henry	*New Zealand*						
	Proxy: P. Muller	*Great Britain*	180	86	—	168	130	564
46.	A. Sereno	*Portugal*	161	139	74	94	86	554
47.	N. Christiensen	*Denmark*	66	168	52	180	80	546
48.	W. Czinczel	*Germany*	95	103	135	92	120	545
49.	T. Johannessen	*Norway*	85	111	124	87	129	536
50.	John Winn	*New Zealand*						
	Proxy: V. Jays	*Great Britain*	—	176	113	92	151	532
50.	A. Jermakow	*U.S.S.R.*	126	97	88	113	108	532
51.	G. Giudici	*France*	136	82	100	92	105	515
52.	H. Pregaldien	*Belgium*	92	69	86	67	180	494
53.	Sugata	*Japan*						
	Proxy: A. Dreyer	*Germany*	117	85	164	66	52	484
54.	C. Sheldon	*U.S.A.*	113	180	96	89	—	478
55.	F. Martino	*Portugal*	51	67	180	60	114	472
56.	M. Clement	*Southern Rhodesia*						
	Proxy: L. Piesk	*Germany*	109	123	37	75	119	463
57.	J. Oxager	*Denmark*	73	73	180	47	77	450
58.	E. Balasse	*Belgium*	83	81	55	72	151	442
59.	J. Gogorcena	*Spain*	83	75	85	95	100	438
60.	V. Matute	*Spain*	96	67	77	87	98	425
61.	F. Mortensen	*Denmark*	54	83	31	180	33	381
62.	G. Dalseg	*Norway*	78	75	33	79	29	294
63.	P. Gonzalez	*Spain*	11	47	71	61	50	240

Power team results

1.	Hungary	2442	7.	Finland	2182
2.	Czechoslovakia	2408	8.	Sweden	2128
3.	Switzerland	2354	9.	Germany	2042
4.	Canada	2333	10.	Italy	2023
5.	G.B.	2326	11.	U.S.S.R.	2010
6.	Austria	2217	12.	Yugoslavia	1994

A/2 results

1.	A. Averijanov	U.S.S.R.	180	180	180	180	180	900 +171
2.	P. Soave	Italy	180	180	180	180	180	900 +159
3.	G. Kalen	Sweden	180	180	180	180	180	900 +147
4.	T. Van't Rood	Netherlands	180	180	180	180	180	900 +131
5.	A. Rodrigues	Portugal	180	180	180	162	180	882
6.	J. Michalek	Czechoslovakia	180	180	147	180	180	867
7.	M. Hlubocky	Czechoslovakia	180	180	180	180	135	855
8.	J. Daley (jun.)	U.S.A.	180	180	123	180	178	841
9.	L. Lortz	U.S.A.	180	180	180	180	102	822
10.	R. Guilloteau	France	98	180	180	180	180	818
11.	T. Strang	Finland	180	89	180	180	180	809
11.	P. Teunisse	Netherlands	180	110	180	180	159	809
11.	O. Schnurer	Austria	180	180	180	180	89	809
12.	**G. W. Dallimer**	**G.B.**	180	180	87	180	180	807
12.	**A. G. Freeston**	**G.B.**	154	164	180	180	129	807
13.	K. Gunther	Germany	124	180	180	180	142	806
14.	A. Sulisz	Poland	81	180	180	180	180	801
15.	H. Schnurer	Austria	180	180	136	119	180	795
16.	J. Schulten	Netherlands	152	123	154	80	180	789
17.	A. Boncompagni	Italy	180	180	156	128	137	781
18.	A. Skard	Norway	151	180	180	105	150	766
19.	M. Pyykko	Finland	180	180	141	132	127	760
20.	R. Borras	France	115	180	180	180	96	751
21.	W. Cook	New Zealand						
	Proxy: M. Schmidt	Germany	106	180	180	180	103	749
22.	C. Boscurol	Italy	152	180	180	78	149	739
23.	I. Spejzl	Czechoslovakia	180	64	180	180	132	736
24.	S. Takko	Finland	68	180	170	171	142	731
25.	G. Simon	Hungary	180	93	135	130	180	718
26.	McGarvey	New Zealand						
	Proxy: G. Roemer	Germany	82	180	180	177	96	715
27.	J. Malkin	New Zealand						
	Proxy: G. Mailbaum	Germany	180	54	180	180	110	704
28.	E. Berg	Denmark	80	90	164	180	180	694
29.	A. Semskij	U.S.S.R.	76	180	180	124	130	690
30.	A. Hermann	Germany	139	180	180	112	77	688
31.	H. Michel	Switzerland	97	180	180	180	49	686
31.	J. McGillivray	Canada	101	180	180	91	134	686
32.	I. Sares	Sweden	64	180	113	180	148	685
33.	F. Fernandez	Spain	119	180	180	121	79	679
34.	V. Miroslav	Yugoslavia	71	180	180	180	64	675
35.	T. Borthne	Norway	180	91	55	180	168	674
36.	R. Leduc	Belgium	156	180	180	75	80	671
37.	G. Giudici	France	180	95	180	76	135	666
38.	A. Hansen	Denmark	180	55	56	180	180	651
39.	J. Glod	Luxemburg	180	149	35	180	103	647
40.	A. Mederer	Germany	78	108	119	180	157	642
40.	J. Nestratow	U.S.S.R.	131	74	118	180	139	642
41.	S. Babic	Yugoslavia	106	65	76	180	171	598
41.	P. W. Visser	South Africa	178	61	149	139	71	598
42.	Mrs. E. Bell	U.S.A.	180	44	180	71	113	588
43.	A. Hertig	Switzerland	97	65	63	180	180	585
44.	B. Hansen	Denmark	180	82	180	52	89	584
45.	G. Fitzpatrick	Ireland	83	180	65	180	68	576
46.	St. Rozycki	Poland	81	52	173	180	87	573
47.	**B. L. Halford**	G.B.	87	80	83	180	141	571
48.	M. Sousa	Portugal	76	77	180	147	82	562
49.	J. Benedikt	Poland	92	92	109	117	151	561
50.	B. O. Modeer	Sweden	91	83	180	173	32	559
51.	P. Stevo	Yugoslavia	67	77	113	180	119	556
52.	R. De Graef	Belgium	82	83	80	180	90	515
53.	H. Kargl	Austria	80	53	180	58	135	506
54.	Ch. Bachmann	Switzerland	41	102	180	75	104	502
55.	D. Mackenzie	Canada	115	49	49	180	97	490
56.	R. Hassrod	Norway	180	59	69	44	135	487
57.	B. Price	Canada	180	56	47	80	115	478
58.	J. Guffens	Belgium	57	99	103	99	112	470
59.	L. Pando	Spain	180	61	29	75	107	452
60.	J. M. Leick	Luxemburg	78	74	119	28	143	442
61.	F. Kraemer	Luxemburg	133	32	43	92	111	411
62.	A. Sereno	Portugal	92	58	76	72	62	360
63.	S. Gonzalez	Spain	70	27	92	63	82	334

1.	Holland	2,498
2.	Czechoslovakia	2,459
3.	Italy	2,420
4.	Finland	2,300
5.	U.S.A.	2,251

1961

Leutkirch

AERO MODELLER

Wakefield Results

Name	Nation	1	2	3	4	5	Tota
1. J. Loffler	E. Germany	180	180	180	180	180	900
	Fly-off	+	210	240	243		
A. Hakanson	Sweden	180	180	180	180	180	900
	Fly-off	+	210	240	186		
B. Murari	Italy	180	180	180	180	180	900
	Fly-off	+	210	232	—		
H. Wagner	Austria	180	180	180	180	180	900
	Fly-off	+	185	—	—		
5. R. Sundin	Sweden	180	162	180	180	180	882
6. E. Melentiev	U.S.S.R.	180	180	161	180	180	881
7. A. Petiot	France	156	180	180	180	180	876
7.J. McGillivray	Canada	180	180	177	180	159	876
9. S. Galgoczi	Hungary	180	180	180	150	180	870
10. A. Mabille	Belgium	149	180	180	180	180	869
11. J. O'Donnell	G.B.	161	180	180	161	180	862
12. V. Zapachni	U.S.S.R.	172	180	142	180	180	854
13. E. Fresl	Yugoslavia	180	165	180	144	180	849
14. G. Cassi	Italy	158	180	151	178	180	847
14. R. Koen	Turkey	180	180	180	180	127	847
16. J. Schulten	Netherlands	180	180	142	180	164	846
17. P. Aalto	Finland	180	171	180	134	180	845
18. J. Meyer	Switzerland	121	180	180	180	180	841
19. W. Pulik	E. Germany	180	180	180	118	180	838
20. J. Merory	Yugoslavia	116	180	180	180	180	836
21. C. Hewel	W. Germany	180	154	180	141	180	835
22. K. Kongsberg	Denmark	180	180	113	180	180	833
23. A. Alinari	Italy	125	180	164	180	180	829
24. V. Kmoch	Yugoslavia	180	121	180	169	178	828
25. P. Den Oden	Netherlands	125	180	180	162	180	827
26. G. Krizsma	Hungary	180	180	180	105	180	825
27. R. Eisen	W. Germany	167	180	115	180	180	822
28. R. Liechti	Switzerland	180	171	180	120	162	813
29. D. Kneeland	U.S.A.	180	180	180	89	180	809
30. S. O'Connor (proxy Eigner)	Australia	180	180	144	141	160	805
31. M. Segrave	Canada	180	125	180	180	133	798
31. Ono A. (proxy Haiden)	Japan	94	160	180	180	180	794
33. W. McGarvey	New Zealand	180	128	180	120	180	788
34. L. Pureai	Hungary	180	180	64	180	180	784
35. L. P. Riffaud	France	162	137	150	180	154	783
35. E. Nienstaedt	Denmark	145	180	98	180	180	783
37. L. Tlapak	Austria	180	180	62	180	180	782
38. A. McCauley (proxy R. Magill)	New Zealand	180	180	75	180	164	779
39. R. G. McGlashan	Canada	180	180	51	180	180	771
40. E. Kaslev	Bulgaria	115	180	180	113	180	768
41. K-E. Widell	Denmark	147	171	82	180	180	760
42. M. Rohlena	Czechoslovakia	175	180	94	128	180	757
43. C. Hermes	U.S.A.	180	91	180	105	180	736
44. J. Gabris	Czechslovakia	158	180	134	98	161	731
45. L. Muzny	Czechoslovakia	137	116	180	132	165	730
46. A. Rodriques	Portugal	136	180	82	180	128	706
47. C. Rothenberger	Switzerland	180	180	180	22	137	699
48. N. E. Hollander	Sweden	157	154	68	139	180	698
49. E. Hamaleinen	Finland	180	98	180	111	128	697
49. F. Strzys	E. Germany	153	180	59	125	180	697
51. D. Latter	G.B.	180	180	59	96	180	695
52. M. Carlos	France	112	180	76	131	155	654
53. M. Reichenbach	W. Germany	170	180	60	105	122	637
54. F. Breith	Austria	76	136	180	64	180	636
55. S. Nevenkin	Bulgaria	109	67	180	99	180	635
55. S. Cannizzo	U.S.A.	30	180	138	149	138	635
57. C. Merseburger	Spain	135	91	60	180	162	628
58. K. Omura (proxy Hlavka)	Japan	158	180	105	103	77	623
59. T. Owada (proxy Schneck)	Japan	139	180	65	118	119	621
60. L. Serrano	Brazil	149	95	180	56	134	614
61. N. Burger	Netherlands	126	141	42	180	117	606
62. B. Rowe	G.B.	116	66	116	155	142	595
63. B. Storgards	Finland	88	92	80	123	180	563
64. J. Malkin (proxy E. Malkin)	New Zealand	78	121	180	63	116	558
65. A. G. Martinez	Spain	87	5	180	103	171	546
66. M. F. Sousa	Portugal	84	101	180	62	105	532
67. A. Mirtschev	Bulgaria	173	74	6	88	149	490
68. A. C. Sereno	Portugal	80	180	180	—	—	440

Wakefield Team Results

1. Italy	2576	7. Denmark	2376
2. Yugoslavia	2513	8. Switzerland	2353
3. Sweden	2480	9. Austria	2318
4. Hungary	2479	10. France	2313
5. Canada	2445	11. W. Germany	2294
6. E. Germany	2435	12. Netherlands	2279

F.A.I. Power Results

Name	Nation	1	2	3	4	5	Total
1. E. Frigyes	Hungary	180	180	180	180	180	900
	Fly-off	+	210	240	270		
L. Laxmann	Finland	180	180	180	180	180	900
	Fly-off	+	210	240	233		
D. Galbreath	U.S.A.	180	180	180	180	180	900
	Fly-off	+	210	240	223		
A. Dall'Oglio	Italy	180	180	180	180	180	900
	Fly-off	+	210	201	—		
5. A. C. Sereno	Portugal	180	180	178	180	180	898
6. G. R. French	G.B.	180	180	180	180	166	886
7. K. Keinrath	Austria	164	180	180	180	180	884
8. K. Braasch	East Germany	162	180	180	180	180	882
9. M. H. Green	G.B.	180	161	180	180	180	881
10. B. Bulukin	Norway	160	180	180	180	180	880
11. A. Meczner	Hungary	180	158	180	180	180	878
12. I. Henry (proxy V. Jays)	New Zealand	180	180	156	180	180	876
13. V. Hajek	Czechoslovakia	176	180	159	180	180	875
14. F. Grifoni	Italy	180	180	180	153	180	873
15. Y. Joostens	Belgium	180	180	155	180	172	867
16. S. Pimenoff	Finland	161	180	180	180	161	862
16. Z. Malina	Czechoslovakia	180	180	180	142	180	862
18. Z. Merkez	Yugoslavia	180	180	180	180	135	855
19. K-H Rieke	West Germany	180	180	180	180	130	850
19. T. Van Dijk	Netherlands	130	180	180	180	180	850
19. P. Broerse	Netherlands	180	180	130	180	180	850
22. R. Kammer	East Germany	180	126	180	180	180	846
23. D. Surry	Canada	120	180	180	180	180	840
24. J. Warnock	U.S.A.	130	180	163	180	180	833
25. B. Filimonov	U.S.S.R.	180	111	180	180	180	831
26. V. Pecorari	Italy	180	133	180	180	152	825
27. M. Bourgeois	France	150	136	178	180	180	824
28. F. Spearman	U.S.A.	134	149	180	180	180	823
29. A. Gorgocena	Spain	180	163	118	180	180	821
30. G. Simon	Hungary	180	180	129	180	151	820
31. K. Baje	Austria	180	180	180	180	94	814
32. D. S. Posner	G.B.	180	180	112	180	160	812
33. J. Cerny	Czechoslovakia	144	123	180	180	180	807
34. R. Hagel	Sweden	147	112	180	180	180	799
35. H. Beck	West Germany	180	165	148	180	116	789
36. A. C. Leite	Portugal	180	180	180	162	86	788
37. R. Rudolph	West Germany	175	125	124	180	178	782
38. R. Zimmer	France	180	146	87	180	180	773
39. H. Raulio	Finland	144	160	85	180	180	769
40. P. Lagan (proxy P. Buskell)	New Zealand	135	180	180	111	158	764
41. T. Wiegers	Netherlands	180	119	157	128	172	756
42. V. Kmoch	Yugoslavia	127	117	147	180	180	751
43. R. Bekkelund	Norway	180	180	180	—	180	720
44. J. Foley	Canada	136	115	101	180	180	712
45. R. Schenker	Switzerland	78	79	179	180	180	696
46. F. Kraemer	Luxembourg	180	62	180	180	85	687
47. S. Agner	Denmark	180	180	100	113	102	675
48. J. O'Sullivan	Ireland	85	85	180	180	136	666
49. U. Carlsson	Sweden	180	180	134	124	25	643
50. M. Doyle	Ireland	111	124	90	180	132	637
51. A. Lundin	Sweden	180	85	59	126	180	630
52. I. Sverdrup	Norway	26	180	156	80	180	622
53. N. Christensen	Denmark	107	28	116	180	180	611
54. M. Zupanski	Yugoslavia	—	180	171	105	154	610
55. E. Eng	Switzerland	140	157	79	131	86	593
56. H. J. Benthin	East Germany	150	111	101	80	144	586
57. A. Schlosberg	Israel	40	180	117	180	46	563
58. J. Scott (proxy J. McGillivray)	Canada	76	169	180	103	31	559
59. M. Scott (proxy K. Glynn)	New Zealand	161	180	37	50	120	548
60. A. Schiller	Switzerland	180	124	180	9	—	493
61. M. J. Soares	Portugal	93	180	135	—	82	490
62. C. Guilloteau	France	107	81	86	76	140	490
63. O. Ebner	Austria	127	147	76	9	—	359
64. E. Nienstaedt	Denmark	130	93	8	—	—	231

F.A.I. Power Team Placings

1. Italy	2598	5. Czechoslovakia	2544
1. Hungary	2598	6. Finland	2531
3. Great Britain	2579	7. Netherlands	2456
4. U.S.A.	2556	8. West Germany	2421
		9. East Germany	2314
		10. Norway	2222
		11. Yugoslavia	2216
		12. New Zealand	2188

1963

WIENER-NEUSTADT

A/2 Glider Results

Name	Nation	1	2	3	4	5	Total
1. G. Erichsen	W. Germany	180	180	180	180	180	900
2. E. Avory	Canada	180	180	180	180	171	891
3. B. Modeer	Sweden	180	180	168	180	180	888
4. E. Nicolaas	Netherlands	171	180	155	180	180	866
5. P. McQueen	Canada	180	177	145	180	180	862
6. B. Roschin	U.S.S.R.	136	180	180	180	180	856
7. V. Simonov	U.S.S.R.	142	180	180	180	168	850
8. L. Lultchev	Bulgaria	147	162	180	180	180	849
9. P. Soave	Italy	126	180	180	180	180	846
10. A. Riflawi	Israel	173	120	180	180	178	831
10. I. Zlatev	Bulgaria	168	180	180	180	123	831
12. F. Polak	Netherlands	110	180	180	180	180	830
13. A. Koval	U.S.S.R.	104	180	180	180	177	821
14. A. Schlosberg	Israel	92	180	180	180	180	812
15. T. Van't Rood	Netherlands	179	180	156	180	116	811
16. M. Benedik	Yugoslavia	171	180	180	88	180	799
17. F. Gaensli	Switzerland	175	180	165	91	180	791
18. G. Foucart	Belgium	180	180	180	157	92	789
18. S. Maupetit	France	87	180	180	180	162	789
20. A. Franke	E. Germany	180	180	123	123	180	786
21. O. Prochazka	Czechoslovakia	180	180	124	180	119	783
21. B. Hansen	Denmark	180	180	76	180	167	783
23. J. Michalek	Czechoslovakia	128	127	165	180	180	780
24. F. Weyrauther	W. Germany	78	180	180	180	157	775
25. F-J. Meister	W. Germany	111	180	180	121	180	772
26. I. Alm	Sweden	45	180	180	180	180	765
27. A. Hietanen	Finland	106	156	180	180	141	763
28. N. Hopley	New Zealand	180	39	180	180	180	759
29. M. Lesobre (proxy Bourgeouis)	France	107	180	171	180	118	756
29. U. Acuto	Italy	180	65	180	180	151	756
31. E. Hopper	U.S.A.	80	144	180	180	160	744
32. J. Larsen	Denmark	180	140	98	180	145	743
32. C. Boscarol	Italy	180	106	180	115	162	743
34. N. Ingersoll	U.S.A.	180	19	180	180	180	739
35. M. Burrows	G.B.	142	180	54	180	178	734
36. S. Paulin	Yugoslavia	129	180	114	180	129	732
37. C. Jackson	G.B.	113	180	143	180	112	728
38. J. Baguley	G.B.	152	180	78	180	136	726
39. M. Hlubocky	Czechoslovakia	174	180	58	180	131	723
40. D. Ducklauss	E. Germany	122	134	157	163	145	721
41. J. Waanaen	Finland	124	180	180	65	170	719
41. O. Zitkon	Austria	95	180	180	180	84	719
43. M. Doyle	Ireland	160	180	180	110	87	717
44. P. Lauridsen	Denmark	77	180	148	180	120	705
45. M. Koller	Austria	108	180	154	137	118	697
46. A. Gogorcena	Spain	112	161	78	180	161	692
47. W. McGarvey	New Zealand	74	180	180	149	93	676
48. W. Thomson	Canada	130	65	180	113	180	668
49. F. Solakovic	Yugoslavia	105	180	105	180	94	664
50. J. Jauquemart	Luxembourg	69	179	180	89	139	656
51. R. Blacher	Austria	139	120	127	180	89	655
52. M. Da Silva Amado	Portugal	180	180	142	48	85	635
53. S. Costa	Portugal	163	74	143	100	151	631
54. W. Haller	Switzerland	159	180	71	103	115	628
55. R. Verdren	Belgium	82	117	180	180	60	619
56. K. J. Butz	E. Germany	120	69	180	91	154	614
56. A. Frost	U.S.A.	147	59	180	115	113	614
58. L. Braire	France	123	180	97	26	180	606
59. J. Feron	Belgium	84	46	180	146	130	586
60. P. Thompson	Ireland	56	115	126	180	108	585
61. R. Skold	Sweden	113	50	113	180	126	582
62. J. O'Sullivan	Ireland	89	65	180	134	105	573
63. K. Abadjiev	Bulgaria	165	150	69	140	44	568
64. E. Malkin	New Zealand	38	70	180	136	128	552
65. G. Herzberg	Israel	113	81	180	36	141	551
66. B. Pereira	Portugal	94	93	176	156	21	540
67. F. Meyer	Switzerland	118	27	42	180	130	497
68. W. Bjorn	Finland	108	87	57	69	141	462
69. M. Thies	Luxembourg	43	60	42	161	146	452
70. N. Merles	Luxembourg	26	58	180	33	103	400
71. P. G. Lengomin	Spain	112	95	24	46	119	396

Team Results A/2 Glider

1. U.S.S.R.	2527	8. Sweden	2235
2. Netherlands	2507	9. Denmark	2231
3. W. Germany	2447	10. Yugoslavia	2195
4. Canada	2421	11. Israel	2194
5. Italy	2345	12. G. Britain	2188
6. Czechoslovakia	2286	13. France	2151
7. Bulgaria	2248	14. E. Germany	2121

WAKEFIELD RESULTS

	Name	Nation	1	2	3	4	5	Total
1	Thomas Koster	*Denmark*	180	180	180	180	180	900
		Fly-off +		240	300	360	257	
2	Vladimir Matveev	*U.S.S.R.*	180	180	180	180	180	900
		Fly-off +		240	300	360	217	
3	Bengt Johansson	*Sweden*	180	180	180	180	180	900
		Fly-off +			240	300	196	
4	Lennart Flodstrom	*Sweden*	180	180	180	180	180	900
		Fly-off +					229	
5	Rune Johansson	*Sweden*	180	180	180	180	180	900
		Fly-off +					221	
6	Jurgen Horn	*W. Germany*	180	180	180	180	180	900
		Fly-off +					218	
7	Frank Parmenter	*U.S.A.*	180	180	180	180	180	900
		Fly-off +					212	
8	Egert Oskamp	*Netherlands*	180	180	180	180	180	900
		Fly-off +					200	
9	ALAN ARMES	GT. BRITAIN	180	180	180	180	180	900
		Fly-off +					188	
	Julije Merory	*Yugoslavia*	180	180	180	180	180	900
		Fly-off +					188	
11	Vilim Kmoch	*Yugoslavia*	180	180	180	180	180	900
		Fly-off +					183	
12	Masahiro Itoh	*Japan*	180	180	180	180	180	900
	(*Proxy* J.-olle Akesson)	*Fly-off* +					174	
13	Vladyslav Niestoj	*Poland*	180	180	180	180	178	898
14	Karel Rys	*Czechoslov.*	180	180	176	180	180	896
15	Kurt Sager	*Switzerland*	180	178	180	180	176	894
16	Ronald Magill	*N. Zealand*	180	172	180	180	180	892
17	Johan Schulten	*Netherlands*	180	180	171	180	180	891
18	Emil Frest	*Yugoslavia*	180	180	180	170	180	890
19	Sergio Legnani	*Italy*	180	180	164	180	180	884
19	Arthur Macauley (*Proxy* R. Godden)	*N. Zealand*	180	166	180	178	180	884
21	John Lenderman	*U.S.A.*	180	163	173	180	180	876
22	Gunter Rupp	*W. Germany*	180	180	155	180	180	875
	Vladimir Zviakin	*U.S.S.R.*	180	180	180	180	155	875
	Vincenzo Scardicchio	*Italy*	155	180	180	180	180	875
25	Michael Segrave	*Canada*	180	152	179	180	180	871
26	Joachim Loffler	*E. Germany*	180	180	180	148	180	868
27	Erik Jorgensen	*Norway*	180	144	180	180	180	864
28	Jerzy Kosinski	*Poland*	143	180	180	180	180	863
	Giovanni Cassi	*Italy*	180	180	143	180	180	863
	Jack McGillivray	*Canada*	147	180	180	176	180	863
31	Daniel McDonald	*U.S.A.*	135	180	180	180	180	855
32	Fritz Strzys	*E. Germany*	180	180	180	180	133	853
33	Manfred Reichenbach	*W. Germany*	180	123	180	180	180	843
34	Gad Minikes	*Israel*	160	180	135	180	180	835
35	Peter den Ouden	*Netherlands*	180	180	180	115	177	832
	Erich Rohrer	*Switzerland*	159	143	170	180	180	832
37	Karoly Fischer	*Hungary*	180	127	180	180	164	831
38	Antonin Simerda	*Czechoslov.*	180	107	180	180	180	827
39	M. Boiziau	*France*	180	180	102	180	180	822
40	Erik Nienstaedt	*Denmark*	180	139	140	180	180	819
41	Esko Hamalainen	*Finland*	180	180	98	180	180	818
42	Chaim Kaplan	*Israel*	154	180	119	180	180	813
34	Urs Schaller	*Switzerland*	180	180	89	180	180	809
	Stanislav Zurad	*Poland*	180	150	119	180	180	809
45	Reino Hyvarinen	*Finland*	98	180	168	180	180	806
	Frantisek Dvorak	*Czechoslov.*	180	150	116	180	180	806
	Rone Koen	*Turkey*	180	86	180	180	180	806
48	BRUCE ROWE	GT. BRITAIN	180	89	180	180	169	798
	Robert Rowe	*S. Africa*	145	180	156	180	137	798
50	JOHN O'DONNELL	GT. BRITAIN	111	180	180	144	180	795
51	Vladimir Zapachni	*U.S.S.R.*	93	180	180	150	180	783
52	Karl-Erik Widdel	*Denmark*	171	130	117	180	180	778
53	Brian Roots (*Proxy* B. Halford)	*N. Zealand*	111	180	120	180	180	771
54	M. Degieux	*France*	50	166	180	180	180	756
55	Luis Serrano	*Brazil*	180	106	163	126	180	755
56	Pentti Aalto	*Finland*	162	95	126	180	180	743
57	M. Valery	*France*	110	180	92	180	180	742
58	Horst Kubiak	*E. Germany*	133	84	154	180	180	731
59	Nair Shmueli	*Israel*	121	109	139	180	138	687
60	Peter Visser	*S. Africa*	121	110	127	147	180	685
61	John Swallow	*S. Africa*	133	107	130	180	129	679
62	Henrik Dahl	*Norway*	130	85	100	180	180	675
63	Cordon Hilliam	*Canada*	102	124	175	55	180	636
64	Joseph Gludt	*Luxembourg*	53	60	89	165	180	547

WAKEFIELD TEAM RESULTS

(25 *competing Nations*)

1	Sweden	2700
2	Yugoslavia	2690
3	U.S.A.	2631
4	Netherlands	2623
5	Italy	2622
6	W. Germany	2618
7	Poland	2570
8	U.S.S.R.	2558
9	New Zealand	2547
10	Switzerland	2535
11	Czechoslovakia	2529
12	Denmark	2497
13	GT. BRITAIN	2493

F.A.I. POWER RESULTS

	Name	Nation	1	2	3	4	5	Total
1	Alberto Dall'Oglio	*Italy*	180	180	180	180	180	900
					Fly-off +		240	
2	M. Bourgeois	*France*	180	180	180	180	180	900
					Fly-off +		239	
3	Eugene Verbitki	*U.S.S.R.*	180	180	180	180	180	900
					Fly-off +		227	
4	Benno Schlosser	*W. Germany*	180	180	180	180	180	900
					Fly-off +		223	
5	Victor Onufrienko	*U.S.S.R.*	180	180	180	180	180	900
					Fly-off +		212	
6	GEORGE FRENCH	GT. BRITAIN	180	180	180	180	180	900
					Fly-off +		203	
7	Vladimir Hajek	*Czechoslov.*	180	180	180	180	180	900
					Fly-off +		190	
8	Robert Cherny	*U.S.A.*	180	180	180	180	180	900
					Fly-off +		173	
9	Carlo Lenti	*Italy*	180	180	180	180	180	900
					Fly-off +		163	
10	Jorma Kumpulainen	*Finland*	180	180	180	180	180	900
					Fly-off +		159	
11	Nils Erik Hollander	*Sweden*	180	180	180	180	180	900
					Fly-off +		153	
12	A. Landeau	*France*	180	180	180	180	180	900
					Fly-off +		152	
13	Andras Meczner	*Hungary*	180	180	180	180	180	900
					Fly-of +		142	
14	James Robinson	*U.S.A.*	180	180	180	180	180	900
					Fly-off +		128	
15	Gianfranco Grifoni	*Italy*	180	180	180	180	180	900
					Fly-off +		120	
16	Henry Spence	*U.S.A.*	180	180	180	180	180	900
					Fly-off +		*over-run*	
17	Valentin Mozirski	*U.S.S.R.*	180	180	180	164	180	884
18	Birger Bulukin	*Norway*	180	162	180	180	180	882
19	Brian Eggleston	*Canada*	180	180	180	160	180	880
	Torbjorn Johannessen	*Norway*	180	180	180	168	172	880
21	Niels Christensen	*Denmark*	157	172	180	180	180	869
22	PETER MANVILLE	GT. BRITAIN	164	180	180	164	180	868
23	Ferenc Csizmarik	*Hungary*	141	180	180	180	180	861
24	Don Elliot	*Canada*	132	180	180	180	180	852
25	Paul Lagan (*Proxy* D. Welch)	*N. Zealand*	180	180	164	165	158	847
26	Raymond Hewitson (*Proxy* P. Bayram)	*N. Zealand*	180	180	180	125	180	845
27	Gyula Simon	*Hungary*	180	180	180	140	153	833
28	M. Fernandez	*France*	180	170	141	180	160	831
29	Rudolf Schenker	*Switzerland*	180	163	180	180	108	811
30	Pieter Broerse	*Netherlands*	99	180	180	180	167	806
31	Hans Friis	*Sweden*	180	180	120	180	143	803
	Karl-Heinz Rieke (*Proxy* H. Seelig)	*W. Germany*	180	171	180	94	178	803
33	Martin van Dijk	*Netherlands*	180	180	122	180	129	791
34	MICHAEL GASTER	GT. BRITAIN	180	130	180	180	112	782
35	Fritz Schneeberger	*Switzerland*	180	53	180	180	180	773
36	Zdenek Malina	*Czechoslov.*	180	180	165	63	180	768
37	Josef Blazek	*Czechoslov.*	180	91	180	133	180	764
38	Lasse Laxman	*Finland*	90	180	180	170	142	762
39	Harry Winn (*Proxy* D. Hipperson)	*N. Zealand*	180	180	170	104	127	761
40	Rolf Kammer	*E. Germany*	180	136	163	180	98	757
41	Peter Visser	*S. Africa*	180	180	175	133	58	726
42	Joachim Benthin	*E. Germany*	180	180	152	180	—	692
43	John Swallow	*S. Africa*	114	102	180	180	107	683
44	Robert Rowe	*S. Africa*	—	165	180	180	123	648
45	Peter Spring	*Switzerland*	25	119	180	180	136	640
46	Seppo Haapalainen	*Finland*	134	173	180	26	114	627
47	Carl-Erik Auner	*Sweden*	14	180	180	180	67	621
48	Norbert Czeranowsky	*W. Germany*	152	94	68	64	180	558
49	Eolo Carlini	*Brazil*	—	180	148	125	94	548
50	Michael Segrave	*Canada*	180	69	—	180	104	533
51	Julian Falecki	*Poland*	121	108	7	180	109	525
52	Ferd Kraemer	*Luxembourg*	54	66	76	66	60	322
53	Oyvind Liberg	*Norway*	31	69	—	116	—	216

TEAM RESULTS: F.A.I. POWER

(21 *competing Nations*)

1	Italy	2700
	U.S.A.	2700
3	U.S.S.R.	2684
4	France	2631
5	Hungary	2594
6	G.B.	2550
7	N.Z.	2453
8	Czech.	2432

AERO MODELLER

A/2 GLIDER RESULTS

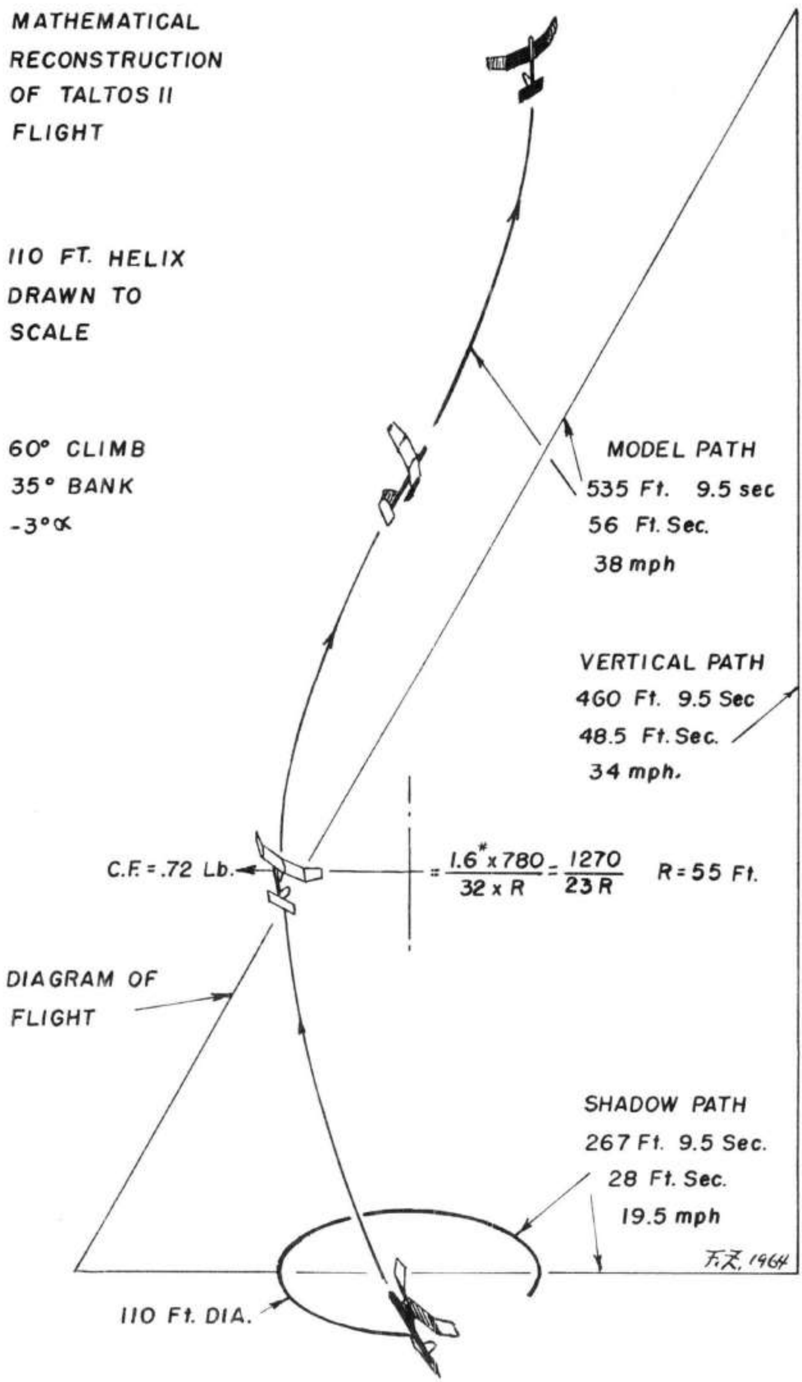
	Name	Nation	1	2	3	4	5	Total
1	Anton Bucher	*Switzerland*	180	180	180	180	180	900
			Fly-off +			240	282	
2	JOHN O'DONNELL	GT. BRITAIN	180	180	180	180	180	900
			Fly-off +			240	152	
3	Kjell Bentzen	*Norway*	180	180	180	180	180	900
			Fly-off +			240	143	
4	Gunner Kalen	*Sweden*	180	180	180	180	180	900
			Fly-off +			240	122	
5	Gerard Klomp	*Netherlands*	180	180	180	180	180	900
			Fly-off +			240	122	
6	Stefan Hubert	*Czechoslov.*	180	180	180	180	180	900
			Fly-off +				210	
7	DAVID TIPPER	GT. BRITAIN	180	180	180	180	180	900
			Fly-off +				193	
8	Thomas Kongsted	*Denmark*	180	180	180	180	180	900
			Fly-off +				122	
9	Herbert Schmidt	*W. Germany*	180	157	180	180	180	877
10	Angus McDonald (*Proxy* M. Dilly)	*N. Zealand*	180	180	180	180	153	873
11	Moshe Goldberg	*Israel*	180	146	180	180	180	866
12	Ivan Horejsi	*Czechoslov.*	138	180	180	180	180	858
	Vasilev Simonov	*U.S.S.R.*	180	180	180	180	138	858
14	Ari Hietanen	*Finland*	134	180	180	180	180	854
15	John Swallow	*S. Africa*	134	180	180	180	175	849
16	ANTHONY YOUNG	GT. BRITAIN	180	140	166	180	180	846
17	Rimas Shourna	*U.S.S.R.*	154	146	180	180	180	840
18	Oldrich Prochazka	*Czechoslov.*	180	119	180	180	180	839
19	Johan Schreiner	*E. Germany*	180	117	180	180	180	837
20	Juri Sokolov	*U.S.S.R.*	180	180	180	116	180	836
21	M. Corbin	*France*	180	135	180	156	180	831
22	Markku Tahkapaa	*Finland*	180	180	180	110	166	816
	Jorgen Larsen	*Denmark*	180	121	180	180	155	816
24	Theo van't Rood	*Netherlands*	170	112	180	180	173	815
25	Ugo Acuto	*Italy*	180	129	180	154	157	800
26	Hans Maassen	*Netherlands*	180	180	145	180	107	792
27	Fritz Gaensli	*Switzerland*	180	180	180	180	69	789
28	Pierre Lommer	*Luxembourg*	97	180	180	180	145	782
29	Dieter Ducklauss	*E. Germany*	180	109	132	180	180	781
30	Paolo Dapporto	*Italy*	180	60	180	165	180	765
31	Paolo Scave	*Italy*	180	113	101	180	180	754
32	Aimar Mattano	*Argentina*	114	180	143	180	127	744
33	Giora Herzberg	*Israel*	180	180	68	180	132	740
34	Peter Allnut	*Canada*	180	73	180	180	119	732
	Dale Wilson	*U.S.A.*	99	180	180	180	93	732
36	Robert Rowe	*S. Africa*	141	169	97	180	142	729
37	Jack McGillivray	*Canada*	180	180	92	95	180	727
38	Josef Bucher	*Switzerland*	180	58	180	180	126	724
39	Inge Sundstedt	*Sweden*	180	180	69	114	180	723
40	Richard Nagler	*W. Germany*	180	180	130	55	175	720
	Knut Andersson	*Sweden*	180	56	155	180	149	720
	Karoly Fischer	*Hungary*	180	108	180	114	138	720
43	M. Braire	*France*	180	180	145	57	155	717
	John Foley	*Canada*	86	180	164	107	180	717
45	Albrecht Oschatz	*E. Germany*	101	74	180	180	180	715
46	David Anderson	*Australia*	180	86	180	180	67	693
47	Heinz Geiger	*W. Germany*	100	180	108	180	111	679
	M. Bolland	*France*	180	86	180	53	180	679
49	Per Grunnet	*Denmark*	106	110	180	95	180	671
50	Brian Glenny (*Proxy* P. Lawson)	*N. Zealand*	180	140	93	74	170	657
51	Peter Visser	*S. Africa*	40	153	180	180	66	619
52	Asmund Skard	*Norway*	180	64	118	76	180	618
53	Abraham Kiflawi	*Israel*	180	84	80	180	88	612
54	Norm Ingersoll	*U.S.A.*	86	145	140	70	158	599
55	Hugh Langevin	*U.S.A.*	121	180	180	35	78	594
	J. Thomson (*Proxy* C. Hayward)	*N. Zealand*	180	101	72	180	61	594
57	Norbet Mertes	*Luxembourg*	42	114	180	130	63	529
58	Torsten Strang	*Finland*	59	155	99	66	148	527
59	Joseph Ewen	*Luxembourg*	46	60	—	85	42	233

FREE FLIGHT WORLD MODEL AIRPLANE CHAMPIONSHIPS 1965
KAUHAVA FINLAND
Lennokkien MM-kilpailut 8-11. 7.

A/2 TEAM RESULTS

(22 *competing Nations*)

1	GT. BRITAIN	2646
2	Czechoslovakia	2597
3	U.S.S.R.	2534
4	Netherlands	2507
5	Switzerland	2413
6	Denmark	2387
7	Sweden	2343
8	East Germany	2333


MATHEMATICAL
RECONSTRUCTION
OF TALTOS II
FLIGHT
110 FT. HELIX
DRAWN TO
SCALE
60° CLIMB
35° BANK
-3° α
MODEL PATH
535 Ft. 9.5 sec
56 Ft. Sec.
38 mph
VERTICAL PATH
460 Ft. 9.5 Sec
48.5 Ft. Sec.
34 mph.
C.F. = .72 Lb.
$= \frac{1.6^{*} \times 780}{32 \times R} = \frac{1270}{23R}$ R = 55 Ft.
DIAGRAM OF
FLIGHT
SHADOW PATH
267 Ft. 9.5 Sec.
28 Ft. Sec.
19.5 mph
F.Z. 1964
110 Ft. DIA.

FACTS OF LIFE

Frank Zaic

On the opposite page is shown the power flight pattern of TALTOS II as it appeared in the CIRCULAR AIRFLOW & MODEL AIRCRAFT. This is very likely the first such diagram ever constructed for a model aircraft.

The most unexpected discovery made while working on this flight pattern was the fact that the wing had to fly at $-3.8°$ angle of attack during the power flight. I knew that models flew at lower angles during power, but did not expect them to be so low. Since we trim for about $6°$ for minimum sink during glide, a shift to $-3.8°$ means a change of over $9°$! Just think, few miliseconds after you release the high powered FAI, it automatically changes its $6°$ glide trim to $-3.8°$ power trim.

The shift, of course, has to be made or the model will loop or shed its wings in front of your face. After all, glide speed of a FAI is around 16 mph, and with wing at $6°$, the lift produced is about 24 ozs. Now increase speed to 38 mph. At $6°$ angle of attack the resulting lift would be 144 ozs. What are you going to do with 144 ozs. when the model weighs only 27 ozs ? And the prop may also have a thrust exceeding 27 ozs ? Obviously, you do not need the wing at all for the climb. In case of TALTOS II, during climb the wing only needs to generate 13 ozs. of lift with which to provide balance to the thrust force and contribute 7 ozs. of vertical lift during power flight.

In connection with $-3.8°$ angle of attack, we should not forget that at such angles the Center of Pressure may be at the Trailing Edge or behind it. So, here we have a situation in which the wing's C.P. is in <u>Front</u> of the C.G. during glide, and <u>BEHIND</u> the C.G. during power flight. Just think of what goes on or has to happen to preserve balance under such conditions when the angle of attack changes $9°$, from plus $6°$ to $-3.8°$.

The power flight analysis of models, ranging from high powered FAIs to Flying Scales, is still on the hazy side. At the moment, power adjustments, if the model lasts long enough, are a process of itsy-bitsy moves to increase or decrease a particular flight pattern. Not a very scientific process, but it has to do until something better comes along.

THANKS TO: Urlan Wannop, Jim Baguley and Brian Faulkner, England; Hugo Benedini, Argentine; Frank Anderson, Canada; Sandro Alinari and Loris Kanneworff, Italy; Radoslav Cizek, Czechoslovakia; Karlheinz Rieke, Gunter Maibaum and Manfred Reichbach, Germany; A. Aarts, Holland; Jim Malkin and Brian Roots, New Zealand; Arnold Degen, Switzerland; Peter Wanngard, Sweden; Dave Linstrum, Dale Willoughby, Bud Tenny, Charles Sotich, fellow SCATs, and to all who helped to shape and form this Year Book.

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CONTRIBUTIONS: If you have a new approach or answer to a problem, write and we will talk about it. Models should have some outstanding characteristics or flight performance which would be useful or of interest to others.

PLANS: Most appreciated are those which are drawn to scale so that they can be traced over. Layout of views does not matter as it can be rearranged during tracing. — It would help if Wakefield, A-2, FAI Power and other large models were drawn to 1/5th Scale. — While A-1, 1/2 A Power, Coupe d'Hiver and similar models can be drawn to 1/4 Scale. — Models with wing span of 20" or less can be done 1/2 size. — Be sure to include full size airfoils. — If 1/5th Scale is not convenient, 3/16" to 1" or 1/4 Scale can be used.

PLAN KIT: Will be sent on request. It contains graph paper to fit your model (10x10 or 8x8 per inch), instructions, sample of work and mailing tube.

Dear Friends and Readers:

This book was begun in January and finished in September; about eight months of full-time work. It would have taken longer, had not many of you helped with articles and ready-to-print plans.---The reason for this long time was that I had to re-establish the Year Book circuit and search through a four-year accumulation of magazines and correspondence to bring the book to date.

While going through the magazines, I could not help but note the change from the early days (1926-1940) to the present. A model builder's life used to be very simple. All models were rubber powered and flown indoor or outdoors. We were like a big happy family: We all spoke the same language, no matter where in the world we happened to find ourselves. But now! -- Our hobby has splintered into so many clans that we act almost like strangers to one another.

It is hard to predict what the future will bring in this clannish atmosphere, but the Year Book wil continue its basic function of recording all activities dealing with flying models, and presenting the over-all picture of model aerodynamics, etc. It does not matter if you are the only one flying a rotor-wing helicopter, the Year Book has a place for it.

Talking about the future, it looks very exciting for R/C. Not in the established pattern-flying R/C, but in the use of R/C for flight experiments. With receivers light enough to be used as ballast in practically every flying model, just imagine what could be accomplished in providing us with facts and figures that are now only being "guestimated"! How many pages should I reserve for your R/C flight research?

With the Year Book circuit re-established and humming, it is hoped that the book will be published annually. Will appreciate whatever you can do to bring this hope to realization.

Frank Zaic

2.54 x In. = Cm.
.394 x Cm. = In.

6.45 x Sq. In. = Sq. Cm.
.155 x Sq. Cm. = Sq. In.

16.4 x Cu. In. = Cu. Cm.
.06 x Cu. Cm. = Cu. In.

28.35 x Ozs. = Grams
.0355 x Grams = Ozs.

.68 x Ft. Sec. = M.P.H.
1.467 x M.P.H. = Ft. Sec.

inches fractions	inches decimals	m m
—	.0004	.01
—	.004	.10
—	.01	.25
1/64	.0156	.397
—	.0197	.50
—	.0295	.75
1/32	.03125	.794
—	.0394	1.
3/64	.0469	1.191
—	.059	1.5
1/16	.062	1.588
5/64	.0781	1.984
—	.0787	2.
3/32	.094	2.381
—	.0984	2.5
7/64	.109	2.778
—	.1181	3.
1/8	.125	3.175
—	.1378	3.5
9/64	.141	3.572
5/32	.156	3.969
—	.1575	4.
11/64	.172	4.366
—	.177	4.5
3/16	.1875	4.763
—	.1969	5.
13/64	.203	5.159
—	.2165	5.5
7/32	.219	5.556
15/64	.234	5.953
—	.2362	6
1/4	.250	6.350
—	.2559	6.5
17/64	.2656	6.747
—	.2756	7.
9/32	.281	7.144
—	.2953	7.5
19/64	.297	7.541
5/16	.312	7.938
—	.315	8.
21/64	.328	8.334
—	.335	8.5
11/32	.344	8.731
—	.3543	9.
23/64	.359	9.128
—	.374	9.5
3/8	.375	9.525
25/64	.391	9.922
—	.3937	10.
13/32	.406	10.319
—	.413	10.5
27/64	.422	10.716
—	.4331	11.
7/16	.438	11.113
29/64	.453	11.509
15/32	.469	11.906
—	.4724	12.
31/64	.484	12.303
—	.492	12.5
1/2	.500	12.700
—	.5118	13.
33/64	.5156	13.097
17/32	.531	13.494
35/64	.547	13.891
—	.5512	14.
9/16	.563	14.288
—	.571	14.5
37/64	.578	14.684
—	.5906	15.
19/32	.594	15.081
39/64	.609	15.478
5/8	.625	15.875
—	.6299	16.
41/64	.6406	16.272
—	.6496	16.5
21/32	.656	16.669
—	.6693	17.
43/64	.672	17.066
11/16	.6875	17.463
45/64	.703	17.859
—	.7087	18.
23/32	.719	18.256
—	.7283	18.5
47/64	.734	18.653
—	.7480	19.
3/4	.750	19.050
49/64	.7656	19.447
25/32	.781	19.844
—	.7874	20.
51/64	.797	20.241
13/16	.8125	20.638
—	.8268	21.
53/64	.828	21.034
27/32	.844	21.431
55/64	.859	21.828
—	.8661	22.
7/8	.875	22.225
57/64	.8906	22.622
—	.9055	23.
29/32	.9062	23.019
59/64	.922	23.416
15/16	.9375	23.813
—	.9449	24.
61/64	.953	24.209
31/32	.969	24.606
—	.9843	25.
63/64	.9844	25.003
1	1.000	25.400
—	1.0236	26.
1-1/32	1.0312	26.194
1-1/16	1.062	26.988
—	1.063	27.
1-3/32	1.094	27.781
—	1.1024	28.
1-1/8	1.125	28.575
—	1.1417	29.

inches fractions	inches decimals	m m
1-5/32	1.156	29.369
—	1.1811	30.
1-3/16	1.1875	30.163
1-7/32	1.219	30.956
—	1.2205	31.
1-1/4	1.250	31.750
—	1.2598	32.
1-9/32	1.281	32.544
—	1.2992	33.
1-5/16	1.312	33.338
—	1.3386	34.
1-11/32	1.344	34.131
1-3/8	1.375	34.925
—	1.3779	35.
1-13/32	1.406	35.719
—	1.4173	36.
1-7/16	1.438	36.513
—	1.4567	37.
1-15/32	1.469	37.306
—	1.4961	38.
1-1/2	1.500	38.100
1-17/32	1.531	38.894
—	1.5354	39.
1-9/16	1.562	39.688
—	1.5748	40.
1-19/32	1.594	40.481
—	1.6142	41.
1-5/8	1.625	41.275
—	1.6535	42.
1-21/32	1.6562	42.069
1-11/16	1.6875	42.863
—	1.6929	43.
1-23/32	1.719	43.656
—	1.7323	44
1-3/4	1.750	44.450
—	1.7717	45.
1-25/32	1.781	45.244
—	1.8110	46.
1-13/16	1.8125	46.038
1-27/32	1.844	46.831
—	1.8504	47.
1-7/8	1.875	47.625
—	1.8898	48.
1-29/32	1.9062	48.419
—	1.9291	49.
1-15/16	1.9375	49.213
—	1.9685	50.
1-31/32	1.969	50.006
2	2.000	50.800
—	2.0079	51.
2-1/32	2.03125	51.594
—	2.0472	52.
2-1/16	2.062	52.388
—	2.0866	53.
2-3/32	2.094	53.181
2-1/8	2.125	53.975
—	2.126	54
2-5/32	2.156	54.769
—	2.165	55.
2-3/16	2.1875	55.563
—	2.2047	56.
2-7/32	2.219	56.356
—	2.244	57.
2-1/4	2.250	57.150
2-9/32	2.281	57.944
—	2.2835	58.
2-5/16	2.312	58.738
—	2.3228	59
2-11/32	2.344	59.531
—	2.3622	60.
2-3/8	2.375	60.325
—	2.4016	61.
2-13/32	2.406	61.119
2-7/16	2.438	61.913
—	2.4409	62.
2-15/32	2.469	62.706
—	2.4803	63.
2-1/2	2.500	63.500
—	2.5197	64.
2-17/32	2.531	64.294
—	2.559	65.
2-9/16	2.562	65.088
2-19/32	2.594	65.881
—	2.5984	66.
2-5/8	2.625	66.675
—	2.638	67.
2-21/32	2.656	67.469
—	2.6772	68.
2-11/16	2.6875	68.263
—	2.7165	69.
2-23/32	2.719	69.056
2-3/4	2.750	69.850
—	2.7559	70.
2-25/32	2.781	70.6439
—	2.7953	71.
2-13/16	2.8125	71.4376
—	2.8346	72.
2-27/32	2.844	72.2314
—	2.8740	73.
2-7/8	2.875	73.025
2-29/32	2.9062	73.819
—	2.9134	74.
2-15/16	2.9375	74.613
—	2.9527	75.
2-31/32	2.969	75.406
—	2.9921	76.
3	3.000	76.200
3-1/32	3.0312	76.994
—	3.0315	77.
3-1/16	3.062	77.788
—	3.0709	78.
3-3/32	3.094	78.581
—	3.1102	79.
3-1/8	3.125	79.375
—	3.1496	80.
3-5/32	3.156	80.169

inches fractions	inches decimals	m m
3-3/16	3.1875	80.963
—	3.1890	81.
3-7/32	3.219	81.756
—	3.2283	82.
3-1/4	3.250	82.550
—	3.2677	83.
3-9/32	3.281	83.344
—	3.3071	84.
3-5/16	3.312	84.1377
3-11/32	3.344	84.9314
—	3.3464	85.
3-3/8	3.375	85.725
—	3.3858	86.
3-13/32	3.406	86.519
—	3.4252	87.
3-7/16	3.438	87.313
—	3.4646	88.
3-15/32	3.469	88.106
3-1/2	3.500	88.900
—	3.5039	89.
3-17/32	3.531	89.694
—	3.5433	90.
3-9/16	3.562	90.4877
—	3.5827	91.
3-19/32	3.594	91.281
—	3.622	92.
3-5/8	3.625	92.075
3-21/32	3.656	92.869
—	3.6614	93.
3-11/16	3.6875	93.663
—	3.7008	94.
3-23/32	3.719	94.456
—	3.7401	95.
3-3/4	3.750	95.250
—	3.7795	96.
3-25/32	3.781	96.044
3-13/16	3.8125	96.838
—	3.8189	97.
3-27/32	3.844	97.631
—	3.8583	98.
3-7/8	3.875	98.425
—	3.8976	99.
3-29/32	3.9062	99.219
—	3.9370	100.
3-15/16	3.9375	100.013
3-31/32	3.969	100.806
—	3.9764	101.
4	4.000	101.600
4-1/16	4.062	103.188
4-1/8	4.125	104.775
—	4.1338	105.
4-3/16	4.1875	106.363
4-1/4	4.250	107.950
4-5/16	4.312	109.538
—	4.3307	110.
4-3/8	4.375	111.125
4-7/16	•4.438	112.713
4-1/2	4.500	114.300
—	4.5275	115.
4-9/16	4.562	115.888
4-5/8	4.625	117.475
4-11/16	4.6875	119.063
—	4.7244	120.
4-3/4	4.750	120.650
4-13/16	4.8125	122.238
4-7/8	4.875	123.825
—	4.9212	125.
4-15/16	4.9375	125.413
5	5.000	127.000
—	5.1181	130.
5-1/4	5.250	133.350
5-1/2	5.500	139.700
—	5.5118	140.
5-3/4	5.750	146.050
—	5.9055	150.
6	6.000	152.400
6-1/4	6.250	158.750
—	6.2992	160.
6-1/2	6.500	165.100
—	6.6929	170.
6-3/4	6.750	171.450
7	7.000	177.800
—	7.0866	180.
—	7.4803	190.
7-1/2	7.500	190.500
—	7.8740	200.
8	8.000	203.200
—	8.2677	210.
8-1/2	8.500	215.900
—	8.6614	220.
9	9.000	228.600
—	9.0551	230.
—	9.4488	240.
9-1/2	9.500	241.300
—	9.8425	250.
10	10.000	254.001
—	10.2362	260.
—	10.6299	270.
11	11.000	279.401
—	11.0236	280.
—	11.4173	290.
—	11.8110	300.
12	12.000	304.801
13	13.000	330.201
—	13.7795	350.
14	14.000	355.601
15	15.00	381.001
—	15.7480	400.
16	16.000	406.401
17	17.000	431.801
—	17.7165	450.
18	18.000	457.201
19	19.000	482.601
—	19.6850	500.
20	20.000	508.001